Community Assistantship Program

Long Lake Wastewater Feasibility Study

The Community Assistantship Program is made possible by the generous support of the McKnight Foundation, the Otto Bremer Foundation, the Southern Initiative Fund, the Initiative Foundation, the Southwest Minnesota Foundation, the Northwest Minnesota Foundation, and the West Central Initiative Fund. Within the University of Minnesota, support is provided by Central Administration, the Rural Development Council, the College of Human Ecology, the University of Minnesota Extension Service, the College of Natural Resources, the College of Education and Human Development, the College of Agriculture, Food and Environmental Sciences, the Minnesota Institute for Sustainable Agriculture, the College of Liberal Arts, the College of Architecture and Landscape Architecture, the Carlson School of Management, the Center for Small Towns, the Center for Urban and Regional Affairs, and the five Regional Sustainable Development Partnerships.

Long Lake Wastewater Feasibility Study

Conducted on behalf of
Long Lake Subordinate Service District

Prepared by
Jamie Bankston, Graduate Research Assistant,
University of Minnesota
1999

CAP Report 007

Project Planning Area:

Location: See the following maps: Long lake property boundary map (fig 1), USGS Map of Long Lake (fig 2), and Aerial Photograph of Long Lake (fig 3). The area surrounding Long Lake is flat in topography and approximately 5.6 miles southwestern edge of St. James proper on highway 4.

Environmental Resources Present: Several areas surrounding long lake are considered wetlands and should not be disturbed by development (fig 4). The Watonwan River runs near the south~~western~~ eastern shore of Long Lake and is the only significant flood plain area (fig 5) near Long Lake residents. The flood plain area near the Watonwan River should not have any sewage treatment systems built there in case of flooding which would therefore cause sewage contamination of the Watonwan River. Care should be taken to limit the impact on the river (fig 5). No historic sites were observed near Long Lake and the presence of endangered species was not determined. The major resources near Long Lake are: Long Lake itself, groundwater, farmland, and some forested area. See Appendix 1 and table 2 for drinking well locations and depths.

Growth Areas and Population Trends: The population of Watonwan county is declining as a whole, roughly 0.2% per year (~ 30 people per year) as based on data from the U.S. census (fig 6). However, the population of Long Lake residents does not follow the Watonwan County negative decline. The Long Lake population is increasing at a rate of approximately one home per year (fig 7). This trend is not surprising, because of the tremendous desire for people to own lake shore homes in Minnesota. If 1 house were built each year on Long Lake, a 20 house increase would be expected in the next twenty years, so for planning purposes approximately 20 new homes will be built on Long Lake by 2020 (~ 24% population increase).

Existing Facilities:

Long Lake: Currently, wastewater from permanent and seasonal homes on Long Lake (fig 1) has been treated in individual sewage treatment systems (ISTS). System types vary dependent on lot size, soil type, and ground water elevation. Typical septic systems for

Long Lake residents are drainfields (75%) or holding tanks (11%) (table 1). Only 29 % of the ISTS have been upgraded within the last five years and are probably the systems in compliance (table 2) leaving approximately 71% of the remaining ISTS out of compliance. Inspection of all ISTS on Long Lake have not been conducted, but the majority of the ISTS are believed to be out of compliance with MN 7080. Thus, updated sewage treatment systems are needed for the property owners surrounding Long Lake. Leaking sewage treatment systems could lead to groundwater contamination, surface water contamination, and destruction of natural resources. In March of 1999, an environmental service ~~and sewage~~ district was formed for Long Lake. A centralized or clustered sewage treatment system with centralized operation and maintenance is desired so the sewage treatment systems remain adequately maintained and comply with MN 7080.

St. James WW facility:

Condition: The St. James wastewater treatment facility is located northeast of Long Lake (fig 8) with a potential hook up connection at the southwestern corner of St. James (fig 8) near memorial park, approximately 5.6 miles from Long Lake on Highway 4. The St. James wastewater treatment facility was built in 1991 and was designed by Bonestroo, Rosene, Anderlik, and Associates, Inc. of St. Paul, Minnesota. This facility contains: a mechanical bar screen, grit removal system, wet well, two primary clarifiers, six aeration tanks, two final clarifiers, an aeration basin, a polymer addition system, one primary anaerobic digester, one sludge storage tank, and a chlorination/dechlorination system. Plant design criteria and permit levels are located in the MPCA water quality division National Pollutant Discharge Elimination System (NPDES) and State Disposal System (SDS) Permit MN 0024759 (appendix 2) and monthly and yearly flows are located in table 3. The design BOD5 is 143 mg/l, the capacity of the plant is 1.5 MG storage with a maximum peak flow design of 6.2 MGD and average design flow of 2.96 MGD. Currently average flows are approximately 2 MGD. Sufficient room is available for added customers to the St. James wastewater plant. Effluent from this facility is continuously discharged into St. James Creek located directly northeast of the facility. The St. James Sewage Treatment plant has received several commendations from the MPCA for reaching treatment goals.

Financial Status of St. James WW plant: As of December 31, 1998 $4.9 million dollars was available to the St. James wastewater treatment plant. Reserve accounts require $32,600 per year and at the end of 1999 $300, 000 will be in this account. The plant charges $1.45 to treat 1000 gallons, $0.85 per customer per month for debt replacement, and $2.00 per month for administration and billing.

Need for the Project:

It is well known that failing septic systems are cause for groundwater contamination and surface water contamination. Currently local governments and state agencies are trying to remedy this problem. Current standards require septic systems to be inspected before future building or renovations can occur. The residents of Long Lake in Watonwan County are aware of the current state of septic systems and realize how important it is to have a properly working septic system. Based on a survey of Long Lake residents (appendix 3) the average age of septic systems was 11.6 years (table 4). The life of a septic system is roughly 10 to 20 years. Based on the average age of septic systems and lot width zoning laws (150 ft width) (fig 9) most septic systems surrounding Long Lake are out of compliance and are probably leaking and contaminating the groundwater and surface water. The following report determined the feasibility and cost-effectiveness of several sewer options for the residents surrounding Long Lake.

Health and Safety: Rules that regard to the health and safety of septic systems are located in the Watonwan County Zoning Ordinances, Minnesota State Chapter 115 and 145 A, and Minnesota Rules Chapter 7080. These rules state that septic systems must not leak and that a minimum lot width of 150 feet is required before any additions or improvements are made to recreational use lake lots. Unsewered systems must be 100 feet from the high water mark and 35 feet from the road right of way. Sewered systems must be 75 feet from the high water mark and 35 feet from the road right of way. Any discharge of sewage into a ISTS must be located a minimum of 3 feet above bedrock and or groundwater.

Growth: The Long Lake population is increasing at a rate of approximately one home per year (fig 7). For planning purposes approximately 20 new homes will be built on Long

Lake by 2020 (~ 24% population increase). Areas of suspected growth are located in the second tier of Long Lake at the northwest corner of the lake and also on the south side of the lake on the Downs family farm. Approximately 12, 150 foot wide lots could be plotted on the Downs lakeshore property and more than 12 lots could be added to the second tier (fig 10).

Alternatives Considered:

Description:

1) Connection of Long Lake residents to St. James sewer
2) Cluster systems containing constructed wetlands and drainfields
3) Centralized pond system
4) ISTS

Design Criteria: Estimated flows for gravity fed systems are based on 100 gpcd for permanent residents connected to a gravity system and 80 gpcd for seasonal residents. Estimated flows for pressurized systems are based on 75 gpcd for both seasonal and permanent residents. Based on a survey of Long Lake residents (table 1) 67% are permanent residents and 33% seasonal and on average 2.3 residents per home (table 4) with 83 homes currently on the lake and a projected estimate of 20 new homes on Long Lake in the next 20 years for a projected estimate of 103 homes on Long Lake. The average BOD5 is estimated at 150 mg/l.

Estimates of Gravity Flow (Year 2020):

= (100 x 0.67 x 103 x 2.3) + (80 x 0.33 x 103 x 2.3)

= 15, 872 gpd (permanent residents) + 6,254 gpd (seasonal residents)

= 22,126 gpd in the year 2020

Estimates of Pressurized Flow (Year 2020):

= (75 x 103 x 2.3)

= 17, 768 gpd (permanent and seasonal residents)

= 17, 768 gpd in the year 2020

Map - Schematic Layout:

See Figure 11 for suitable sewage treatment areas as based by Soil Conservation Service maps.

See Figure 12 for proposed sewer line from Long Lake to St. James

See Figure 13 for proposed locations for wetland and drainage field treatment systems.

See Figure 14 for centralized pond locations

Environmental Impacts: The three environmentally sensitive areas are: Long Lake, groundwater, wetlands, and the Watonwan River.

Land Requirements: Approximately 10 acres of land would be sufficient for all of the above land treatment methods. No land would be required for the pipeline to St. James, because all pipes would be placed in the road easement.

Cost Estimates:

See Tables 5 and 6 for cost of sewer line from Long Lake to St. James

See Tables 7 and 8 for cost of wetland and drainage field treatment systems.

See Tables 9 and 10 for cost of centralized pond system

Advantages/Disadvantages:

St. James: The pipeline to St. James is the most desired by Long Lake residents (table ~~12~~ 4) and would probably last the longest out of all alternatives mentioned, but is the most

forcemain
8in. diam
7.8?

expensive of all alternatives studied. The high cost is due to the large diameter pipe required for gravity sewer flow to the St. James wastewater treatment center. However, there is potential future cost decreases by future residents connecting into the pipeline.

Communal Constructed Wetlands and Drainfield: This is probably the least desirable for Long Lake residents (table 4). Constructed wetlands require a septic tank to remove solids, wetland, and drainfield. By having both a wetland and drainfield, the costs significantly increase with this treatment option. Also, this technology is new and is still being tested for effectiveness.

Centralized Pond Treatment: This option was less desired by Long Lake Residents than individual sewage treatment systems (table 4), but is the most cost effective of the studied alternatives. An advantage to the pond system is that it is very stable and less susceptible to shock loadings. The disadvantage to a pond system is that it is not aesthetically pleasing to residents and may emit odors.

Individiual Systems (ISTS): ISTS systems are not recommended for residents around Long Lake, because of the small lots and limitations of drainfield sites. Storage tanks would be the only other option and would severely limit water usage by permanent residents.

Proposed Project (recommended alternative)

Project Design:

Treatment: Three communal drainfields located on triplicate 3 acre plots of land (fig 15). The system will be sized to allow for alternate year usage. The series of drainfields at each treatment location will be used on alternate years, so neither drainfield would be stressed. New septic tanks would be installed at each residence or newer existing tanks could be tested for leaks and used if no leaks were found.

Pumping Stations: Small pumping stations would be located at each residence to pump the sewage from septic tanks to a centralized holding tank where it would then be discharged into a communal drainfield.

Collection System Layout: See figure 15 for locations of communal drainfields

Cost Estimate: See Tables 11 and 12 for cost of communal drainfields

Conclusions and Recommendations: The communal drainfield is the most cost effective of all of systems studied. Without government subsidy, the cost per resident per month would be approximately $85. This estimate is rather high and would be considerably decreased with the help of government grants. Drainfields are proven wastewater treatment systems and because the systems are communal, upkeep of the drainfield and septic tanks would be performed by a licensed professional and therefore, the life of the systems would be increased and protection of natural resources would be insured.

Table 1:

Dwelling Units	Number	Percent Surveyed
Houses	43	68.3%
Cabins	15	23.8%
Trailer	4	6.3%
Blank	1	1.6%

Build in 5 Years	Number	Percent Surveyed
Yes	10	15.9%
No	52	82.5%
Blank	1	1.6%

Sell w/in 5 Years	Number	Percent Surveyed
Yes	3	4.8%
No	57	90.5%
Blank	3	4.8%

Permanent Resident	Number	Percent Surveyed
Yes	42	66.7%
No	21	33.3%

Sewage Treatment System	Number	Percent Surveyed
Drainfield	47	74.6%
Mound	4	6.3%
Holding Tank	7	11.1%
Privy	3	4.8%
Blank	2	3.2%

Lake Water Quality	Number	Percent Surveyed
Excellent	5	7.9%
Good	28	44.4%
Fair	23	36.5%
Poor	7	11.1%

Total # of Long Lake Residents Included in Survey: 141

Total # of Surveys Returned: 63

Table 2:

				Well Information			
Lot ID	Last Name	First Name	Septic Upgrade	Unique #	Depth (ft)	DTW (ft)	Date
58	Anderson	Clifford					
82	Anderson	James					
50	Benson	Jeffrey					
49	Brudelie/Wiederhoft	Diane/Dale					
87	Dahl	Joseph	5/17/94	131129?	200	30	7/21/79
5	Deegan	James					
19	Deegan, et. al	James					
20	Deegan, et. al	James					
24	Downs	Richard		131168?	184	40	2/8/77
70	Downs	Richard					
65	Downs	Richard					
56	Downs	Richard					
14	Downs	Richard					
57	Downs	Richard					
4	Downs Family Farms						
33	Doyle	John	6/1/94				
43	Engelking	Ernest	8/28/96				
41	Faber	Randall					
60	Finnestad	Vernon					
72	Flohrs	Richard					
51	Freitag	William	10/15/96				
86	Friesen	Bruce		110953	196	40	5/23/77
26	Goldschmidt	Gary		513080	52	37	6/22/92
27	Goldschmidt	Kim					
47	Greig	Curtis					
21	Grosklags	Loretta					
11	Hammer	Luverne					
16	Hansen	Larry					
18	Hanson	Lennis		471815	166	?	6/21/91
76	Heidl	Danny		455935	71	34	11/3/88
69	Henderson	Muriel					
7	Howe	Audrey					
36	Howe	Audrey	10/4/1995 (2 houses)	131160	68	44	12/24/76 ?
75	Hultgren	Joel					
45	Jass	Carl					
74	Jensen	John	6/29/98	471844	76	35	8/29/91
95	Jensen	Leonard					
37	Jeppson	Steve	6/17/98				
30	Johnson	Meryln/Lester					
64	Johnson	J. Henry					
63	Johnson	J. Henry					
59	Johnson	Gary	9/5/96				
92	Johnson	Joyce					
55	Jorgenson	Howard/John	7/7/97				
73	Julian	Thomas					
71	Jurgemeyer	Vernon	10/15/96	579825	61	35	8/9/96

Table 2:

Lot ID	Last Name	First Name	Septic Upgrade	Well Information: Unique #	Depth (ft)	DTW (ft)	Date
40	Kamleiter	Marlene					
17	Knickrehm	Harold		215065	162	50 ?	8/16/73
62	Krenz	Valarious					
44	Kruse	Betty	9/8/95	108288 ?	59	48	11/27/77
84	Linn/Enwall	Laura/Carol		160502	74	35	9/19/79
54	Lofgren	Elvin					
85	Mace	Terry		553988	196	42	11/11/94
98	Menssen	Beverly		511453 ?	172	51	6/29/90
15	Miest	John					
66	Mohlenbrock	Bradley	10/29/96				
34	Mueller	Thomas					
93	Neisen	Urban					
83	Nelson	Timothy	6/19/96	113027	80	34	9/24/75
29	Nelson	Kirby					
61	Nelson	Gerald					
13	Neuman	Terry					
89	Nordby	Merwyn					
39	Nordstrom	Paul					
46	Nordyke	Steven					
101	Oldenburg	MaryLou					
78	Olenius	Curtis					
31	Olson	Leland/Sharon	9/29/95				
100	Olson	Suzann					
88	Onnen	Juanita					
99	Ormsby State Bank						
80	Overson	Lanny					
81	Overson	Lanny					
28	Peterson	Selma					
91	Runge	Dale	6/23/97				
22	Runge	Mark	12/31/96	579808	53	45	6/1/96
25	Sawatzky	Jerry					
79	Sawyer	David		215068 ?	80	35	?
35	Schiltz	Michele					
32	Schroeder	Dwayne					
67	Schutz	Gary	9/9/96	504580	200	46	4/27/90
53	Shellum	Amos	9/12/97	586027	60	43	8/7/96
68	Shiflet	Ronald					
42	Sing	Willis	5/26/94	488123	171	45	2/27/92
77	Skow	Phillip					
9	Smith	Henry					
1	State of MN						
8	State of MN						
10	Style	Vincent					
94	Swanson	Audrey	6/9/94	107152	181	60	6/15/76
97	Teigum	Al	5/28/97				
23	Trickel	Glenn	9/27/95				
12	Walter	John					

Table 2:

Lot ID	Last Name	First Name	Septic Upgrade	Well Information Unique #	Depth (ft)	DTW (ft)	Date
2	Watonwan County						
102	Wenstrom	Evelyn					
3	Wenstrom	Evelyn					
38	Westman	Steve		131161	69	40	12/27/76
48	Westman	Todd					
90	White	Guy	7/29/94				
52	Williams	Lucille	8/7/96				
96	Wolner	Gary					

Table 3:

Monthly and Yearly WW Flows at the St. Japes WW Plant in MGD million gal/day

	1994	1995	1996	1997	1998	1999
January	30.428	29.026	32.321	28.241	26.290	28.240
February	27.738	27.083	33.447	27.980	25.890	27.470
March	38.221	41.269	35.248	47.100	38.690	31.352
April	44.782	49.341	37.389	46.440	47.120	46.319
May	43.951	46.154	39.734	40.910	36.545	40.748
June	39.987	39.970	52.197	40.410	32.357	36.642
July	36.436	40.530	36.182	44.170	30.243	37.837
August	38.689	42.340	38.730	36.830	32.090	
September	32.818	31.373	32.289	30.220	28.846	
October	33.063	32.744	29.993	28.860	29.230	
November	29.359	31.623	31.560	25.790	26.720	
December	29.421	28.822	30.239	26.145	26.630	

Table 4:

Statistics	Individual	Communal Drainfields	St. James	Pond	Cost per month ($)
Average	2.4	3.2	1.8	2.9	33.6
StDev	1.4	1.2	1.3	1.2	15.6
Mode	1.0	4.0	1.0	2.0	35.0
Median	2.0	3.0	1.0	3.0	35.0
Minimum	1.0	1.0	1.0	1.0	0.0
Maximum	5.0	5.0	5.0	5.0	55.0

1: Best Option
5: Least Favorable Option

Total # of Long Lake Residents Included in Survey: 141
Total # of Surveys Returned: 63

Table 5:

Sanitary Sewer:

Force main?

Item	Unit	Unit Cost	Quantity	Total Cost
8" Sewer gravity	LF	$ 25.00	44863	$ 1,121,575
every 400 ft. Manholes	Each	$ 1,500.00	112	$ 168,000
Wyes ?	Each	$ 100.00	100	$ 10,000
Pump Stations	Each	$40,000.00	3	$ 120,000
Street Repair	LF	$ 20.00	300	$ 6,000
Estimated Construction Costs				$ 1,425,575
Contingencies (20 %)				$ 285,115
Engineering - Basic Services (6.3%)				$ 89,811
- Construction (6.3%)				$ 89,811
Legal, Fiscal and Administration (2%)				$ 28,512
TOTAL ESTIMATED PROJECT COST				**$ 1,918,824**

+ hook-up

Table 6:

EDU- equivalent dwelling unit

Estimated Cost Per User for Connection to St. James

1 EDU (100 gpd x 2.3)		230 gpd
Number of Current EDU		83
20 % Increase Potential EDU		100

Assessment for Collection System

OMR as op. – same?

Estimated Project Cost	$	1,918,824
Estimated Annual O,M,R op., main., repairs	$	12,000
Assessment Per EDU		$1918824/100
	= $	19,265

Assume Assessment Term of 20 years at 7% interest

A/P	0.09439

Annual Cost		
Assessment=0.09439 x ~~9521~~ 19,265	$	1,818
O,M,R: $10 per month/EDU	$	120
Total	$	1,938
Monthly Cost	**$**	**162**

Table 7:

Constructed Wetlands:

Item	Unit	Unit Cost	Quantity	Total Cost
4" Force Main	LF	$ 12.00	24445	$ 293,340
Home Pump Stations	Each	$ 500.00	100	$ 50,000
Grinder Pump	Each	$ 5,000.00	3	$ 15,000
Wyes	Each	$ 100.00	100	$ 10,000
Septic Tanks	Each	$ 1,500.00	100	$ 150,000
Drainfield Excavation and Piping	Home	$ 1,500.00	100	$ 150,000
Land	Acre	$ 1,500.00	10	$ 15,000
Constructed Wetland Cost	Home	$ 4,000.00	100	$ 400,000
Street Repair	LF	$ 20.00	300	$ 6,000
Estimated Construction Costs				$ 1,089,340
Contingencies (20 %)				$ 217,868
Engineering - Basic Services (6.3%)				$ 68,628
- Construction (6.3%)				$ 68,628
Legal, Fiscal and Administration (2%)				$ 21,787
TOTAL ESTIMATED PROJECT COST				**$ 1,466,252**

Table 8:

Estimated Cost Per User for Communal Wetlands and Drainfields

1 EDU (75 gpd x 2.3)		173 gpd
Number of Current EDU		83
20 % Increase Potential EDU		100
Assessment for Collection System		
Estimated Project Cost	$	1,466,252
Estimated Annual O,M,R	$	12,000
Assessment Per EDU		$1466252/100
	= $	14,721
Assume Assessment Term of 20 years at 7% interest		
A/P		0.09439
Annual Cost		
Assessment=0.09439 x ~~9521~~ 14,721	$	1,390
O,M,R: $10 per month	$	120
Total	$	1,510
Monthly Cost	**$**	**126**

Table 9:

Pond System

Item	Unit	Unit Cost	Quantity	Total Cost
4" Force Main	LF	$ 12.00	17935	$ 215,220
Pump Stations	Each	$ 40,000.00	3	$ 120,000
Wyes	Each	$ 100.00	100	$ 10,000
Septic Tanks	Each	$ 1,500.00	100	$ 150,000
Excavation and Embankment	Pond	$ 70,000.00	1	$ 70,000
Control Structure and Piping	Pond	$ 80,000.00	1	$ 80,000
Outfall Piping	LF	$ 25.00	1320	$ 33,000
Synthetic Liner	Pond	$133,000.00	1	$ 133,000
Rip Rap	Pond	$ 60,000.00	1	$ 60,000
Land	Acre	$ 1,500.00	10	$ 15,000
Fencing/Seeding/Mower	Pond	$ 30,000.00	1	$ 30,000
Gravel Road	LF	$ 6.00	5000	$ 30,000
Street Repair	LF	$ 20.00	300	$ 6,000
Estimated Construction Costs				$ 952,220
Contingencies (20 %)				$ 190,444
Engineering - Basic Services (6.3%)				$ 59,990
- Construction (6.3%)				$ 59,990
Legal, Fiscal and Administration (2%)				$ 19,044
TOTAL ESTIMATED PROJECT COST				**$ 1,281,688**

Table 10:

Estimated Cost Per User for Centralized Pond System

1 EDU (75 gpd x 2.3)	173 gpd
Number of Current EDU	83
20 % Increase Potential EDU	100

Assessment for Collection System

Estimated Project Cost	$ 1,281,688
Estimated Annual O,M,R	$ 12,000
Assessment Per EDU	$1281688/100
	= $ 12,868

Assume Assessment Term of 20 years at 7% interest

A/P	0.09439

Annual Cost	
Assessment=0.09439 x ~~9521~~ 12,868	$ 1,215
O,M,R: $10 per month	$ 120
Total	$ 1,335
Monthly Cost	**$ 111**

Table 11:

Communal Drainfields:

Item	Unit	Unit Cost	Quantity	Total Cost
4" Force Main	LF	$ 12.00	22795	$ 273,540
Home Pump Stations	Each	$ 500.00	100	$ 50,000
Wyes	Each	$ 100.00	100	$ 10,000
Septic Tanks	Each	$ 1,500.00	100	$ 150,000
Drainfield Excavation and Piping	Home	$ 2,000.00	100	$ 200,000
Land	Acre	$ 1,500.00	10	$ 15,000
Street Repair	LF	$ 20.00	300	$ 6,000
Estimated Construction Costs				$ 704,540
Contingencies (20 %)				$ 140,908
Engineering - Basic Services (6.3%)				$ 44,386
- Construction (6.3%)				$ 44,386
Legal, Fiscal and Administration (2%)				$ 14,091
TOTAL ESTIMATED PROJECT COST				**$ 948,311**

Table 12:

Estimated Cost Per User for Communal Drainfields

1 EDU (75 gpd x 2.3)		173 gpd
Number of Current EDU		83
20 % Increase Potential EDU		100
Assessment for Collection System		
Estimated Project Cost	$	948,311
Estimated Annual O,M,R	$	12,000
Assessment Per EDU	$~~126100~~ 948,311/100	
	= $	9,521
Assume Assessment Term of 20 years at 7% interest		
A/P		0.09439
Annual Cost		
Assessment=0.09439 x 9521	$	899
O,M,R: $10 per month	$	120
Total	$	1,019
Monthly Cost	**$**	**85**

Table 13:

Clothes Washer	Number	Percent Surveyed
Yes	44	69.8%
No	17	27.0%
Blank	2	3.2%

Dishwasher	Number	Percent Surveyed
Yes	31	49.2%
No	30	47.6%
Blank	2	3.2%

Water Softener	Number	Percent Surveyed
Yes	42	66.7%
No	19	30.2%
Blank	2	3.2%

Whirlpool	Number	Percent Surveyed
Yes	4	6.3%
No	57	90.5%
Blank	2	3.2%

Garbage Disposal	Number	Percent Surveyed
Yes	20	31.7%
No	41	65.1%
Blank	2	3.2%

Humidifier	Number	Percent Surveyed
Yes	1	1.6%
No	60	95.2%
Blank	2	3.2%

Total # of Long Lake Residents Included in Survey: 141
Total # of Surveys Returned: 63

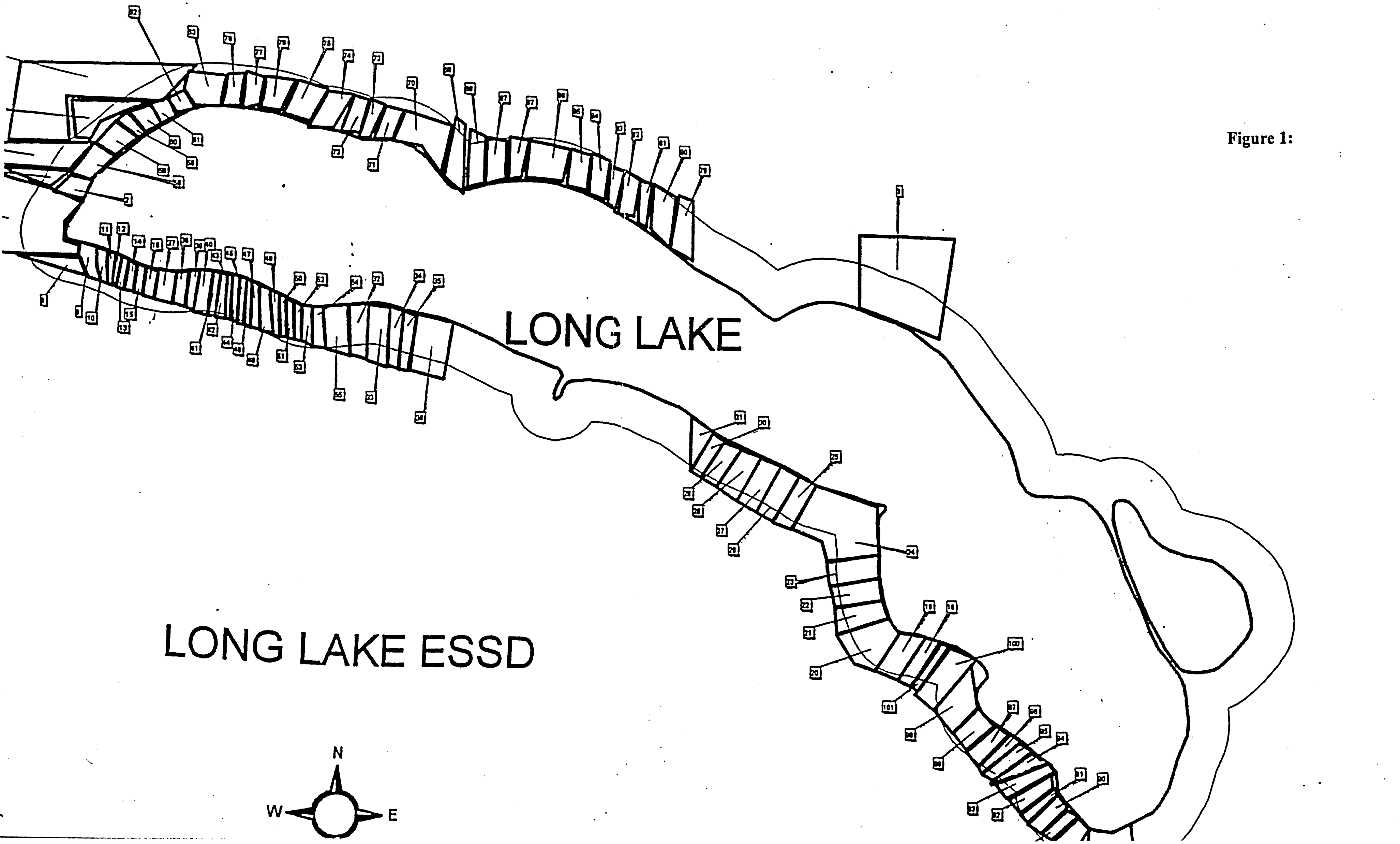
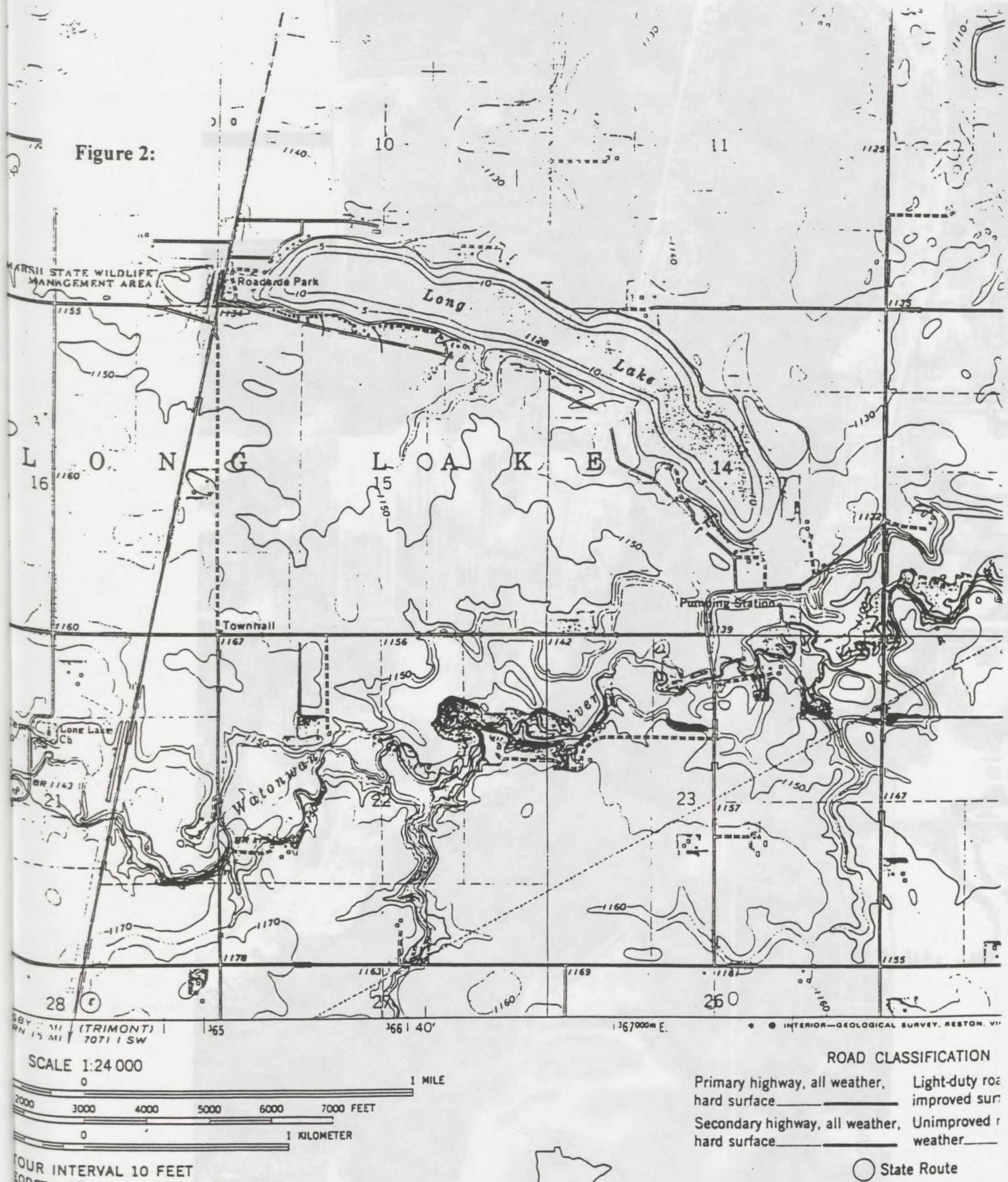


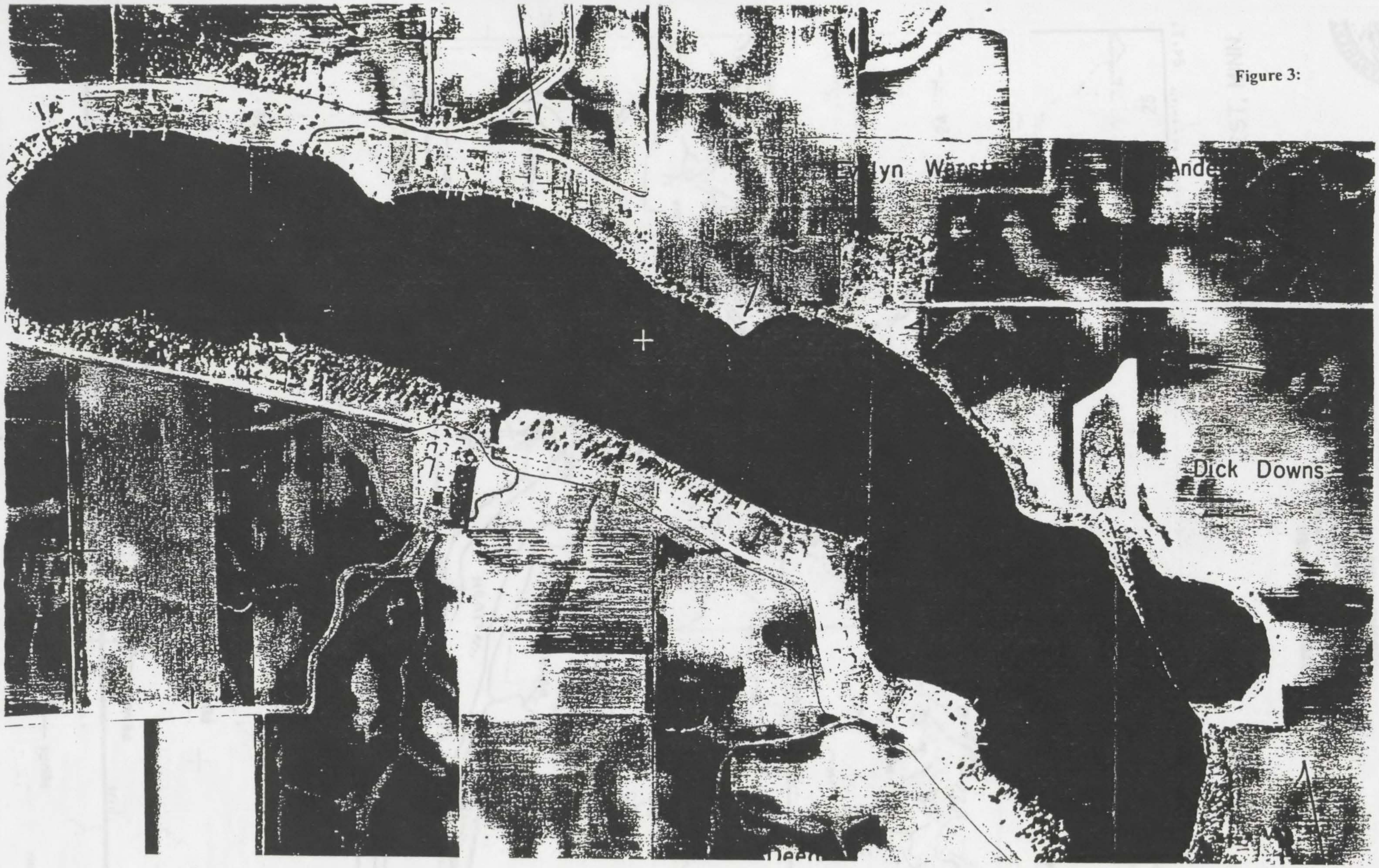
Figure 1:

Figure 2:



MARSH STATE WILDLIFE MANAGEMENT AREA
Roadside Park
Long Lake
L O N G L A K E
Townhall
Pumping Station
Long Lake Cb
Watonwan River
10
11
14
15
16
21
22
23
26
28
1140
1130
1125
1135
1155
1150
1160
1167
1156
1142
1139
1147
1157
1170
1178
1163
1169
1155
(TRIMONT)
7071 I SW
365
366 | 40'
367000m E.
INTERIOR—GEOLOGICAL SURVEY, RESTON, VI
SCALE 1:24 000
0
1 MILE
2000
3000
4000
5000
6000
7000 FEET
0
1 KILOMETER
TOUR INTERVAL 10 FEET
EODETIC VERTICAL DATUM OF 1929
MINN.
QUADRANGLE LOCATION
ROAD CLASSIFICATION
Primary highway, all weather, hard surface
Secondary highway, all weather, hard surface
Light-duty roa improved sur
Unimproved r weather
State Route
WITH NATIONAL MAP ACCURACY STANDARDS
OLOGICAL SURVEY, RESTON, VIRGINIA 22092
APHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled from aerial photographs taken 1977. Map edited 1979
This information not field checked
Purple tint indicates extension of urban area
ST. JAMES WE
N4352.5—W94
1970
PHOTOREVISE

Figure 3:



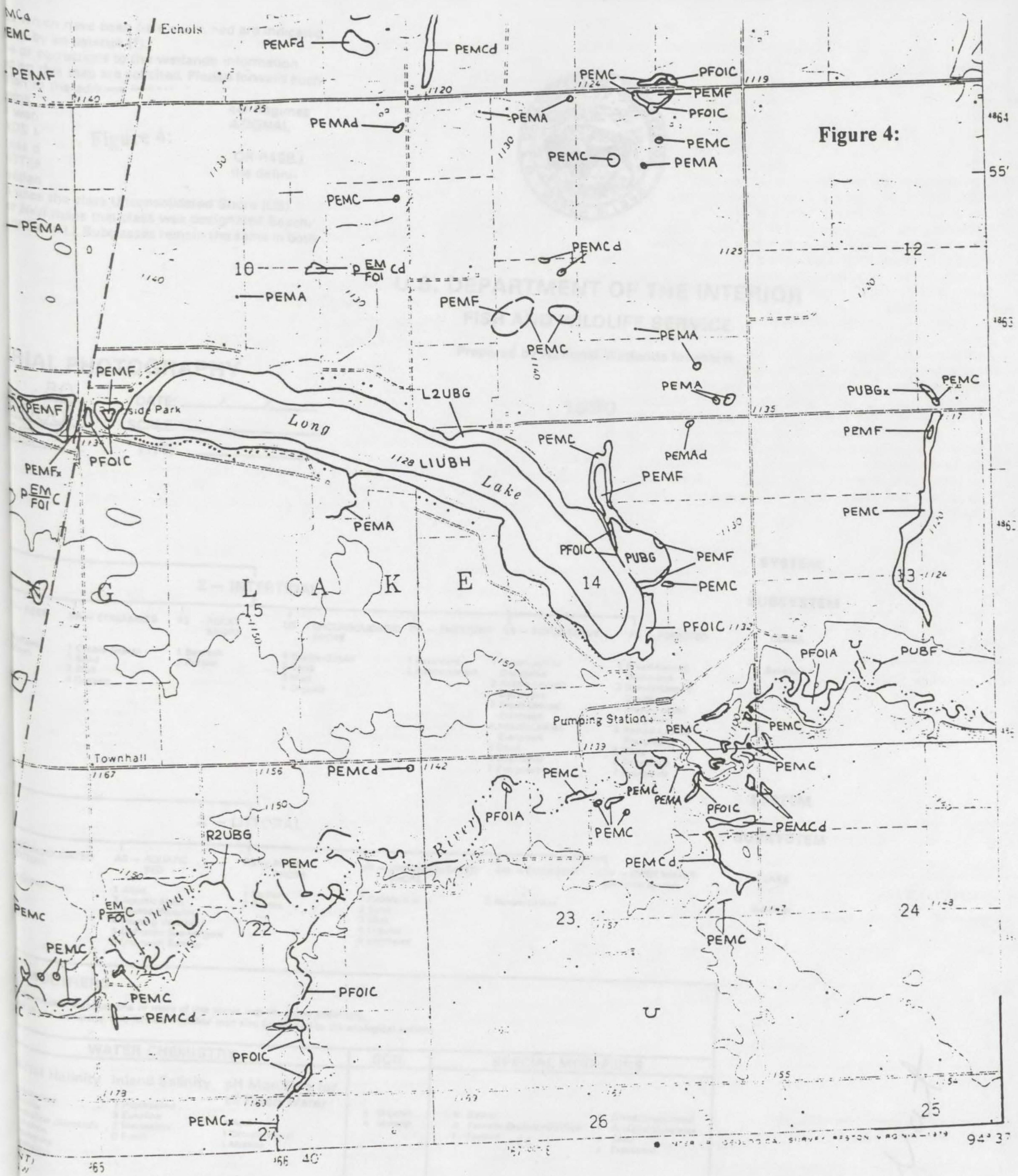


Figure 4:

ST. JAMES WEST, MINN.

NOTES TO THE USER

- Wetlands which have been field examined are indicated on the map by an asterisk (*).
- Additions or corrections to the wetlands information displayed on this map are solicited. Please forward such information to the address indicated.
- Subsystems, Classes, Subclasses, and Water Regimes

EXAMPLE

SYSTEM

SUBSYSTEM

us which have been field exam..ned are indicated
map by an asterisk (*).
ns or corrections to the wetlands information
ed on this map are solicited. Please forward such
ition to the address indic...
tems,
s wer
NDS l
reas d
MITTEN
wetlan
p uses the class Unconsolidated Shore (US).
er NWI maps that class was designated Beach/
, or Flat (FL). Subclasses remain the same in both

Figure 4:

...ter Regimes
...ATIONAL

OR R4SBJ
...the defini-

U.S. DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

Prepared by National Wetlands Inventory

...ERIAL PHOTOGRAPHY

1990

.../80	DATE:	___/___/___
...000	SCALE:	
CIR	TYPE:	

SYSTEM

2 — INTERTIDAL — SUBSYSTEM

... — REEF	SB — STREAMBED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE	EM — EMERGENT	SS — SCRUB-SHRUB	FO — FORESTED	CLASS
...Mollusc ...Worm	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	Subclass

SYSTEM

2 — LITTORAL — SUBSYSTEM

...UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE	EM — EMERGENT	OW — *OPEN WATER/ Unknown Bottom*	CLASS
...e-Gravel ...ic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent		Subclass

MODIFIERS

...deepwater habitats one or more of the water regime, water chemistry,
...vel in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER CHEMISTRY			SOIL	SPECIAL MODIFIERS	
...astal Halinity	Inland Salinity	pH Modifiers for all Fresh Water			
...perhaline ...haline ...ohaline *(Brackish)* ...yhaline ...sohaline ...gohaline ...sh	7 Hypersaline 8 Eusaline 9 Mixosaline 0 Fresh	a Acid t Circumneutral i Alkaline	g Organic n Mineral	b *Beaver* d *Partially Drained/Ditched* f Farmed	h *Diked/Impounded* r Artificial Substrate s *Spoil* x Excavated

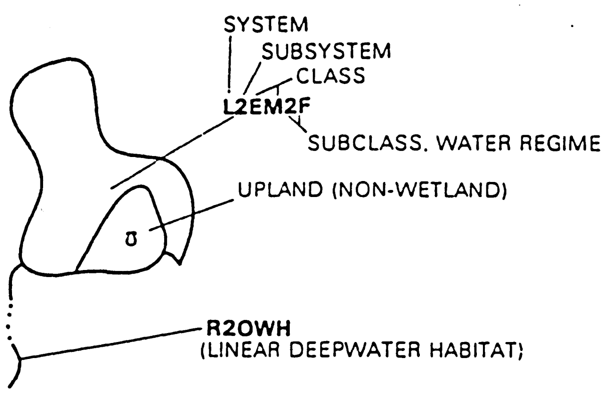
SPECIAL NOTE

This document was prepared primarily by stereoscopic a... photographs. Wetlands were i... based on vegetation, visible h... accordance with **Classifica- t... ater Habitats of the United S... ecember 1979).** The aerial photographs typically reflect conditions during the specific year and season when they were taken. In addition, there is a margin of error inherent in the use of the aerial photographs. Thus, a detailed on the ground and historical analysis of a single site may result in a revision of the wetland boundaries established through photographic interpretation. In addition, some small wetlands and those obscured by dense forest cover may not be included on this document.

Figure 4:

Federal, State and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, State or local government or to establish the geographical scope of the regulatory programs of government agencies. **Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, State or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.**

SYMBOLOGY EXAMPLE



Ʊ — Primarily represents upland areas, but may include unclassified wetlands such as man-modified areas, non photo-identifiable areas and/or unintentional omissions.

NOTES TO

- Wetlands ... on the map
- Additions ... displayed ... information
- Subsystem ... in *Italics* ... WETLAND
- Some area ... (INTERMIT... tion of we...
- This map ... On earlier ... Bar (BB). ... versions.

AE...

DATE: 5 ...

SCALE: 1:65...

TYPE: ...

E — ESTUARINE

NTERTIDAL

REEF — ...al, ...rm

RS — ROCKY SHORE: 1 Bedrock, 2 Rubble

US — UNCONSOLIDATED SHORE: 1 Cobble-Gravel, 2 Sand, 3 Mud, 4 Organic

1 — SUBTIDAL

RB — ROCK BOTTOM: 1 Bedrock, 2 Rubble

UB — UNCONSOLIDATED BOTTOM: 1 Cobble-Gravel, 2 Sand, 3 Mud, 4 Organic

AB — AQUATIC BED: 1 Algal, 3 Rooted Vascular, 4 Floating Vascular, 5 *Unknown Submergent*, 6 *Unknown Surface*

RF — REEF: 2 Mollusc, 3 Worm

OW — *OPEN WATER/ Unknown Bottom*

AB — AQUATIC BED: 1 Algal, 3 Rooted Vascular, 4 Floating Vascular, 5 *Unknown Submergent*, 6 *Unknown Surface*

L — LACUSTRINE

4 — INTERMITTENT

5 — UNKNOWN PERENNIAL

UNCONSOLIDATED SHORE: ...ble-Gravel, ...d, ...d, ...anic, ...etated

**EM — EMERGENT: 2 Nonpersistent

OW — *OPEN WATER/ Unknown Bottom*

1 — LIMNETIC

RB — ROCK BOTTOM: 1 Bedrock, 2 Rubble

UB — UNCONSOLIDATED BOTTOM: 1 Cobble-Gravel, 2 Sand, 3 Mud, 4 Organic

AB — AQUATIC BED: 1 Algal, 2 Aquatic Moss, 3 Rooted Vascular, 4 Floating Vascular, 5 *Unknown Submergent*, 6 *Unknown Surface*

OW — *OPEN WATER/ Unknown Bottom*

RB — ROCK BOTTOM: 1 Bedrock, 2 Rubble

UB...

EMERGENT: ...istent, ...persistent

SS — SCRUB-SHRUB: 1 Broad-Leaved Deciduous, 2 Needle-Leaved Deciduous, 3 Broad-Leaved Evergreen, 4 Needle-Leaved Evergreen, 5 Dead, 6 *Deciduous*, 7 *Evergreen*

FO — FORESTED: 1 Broad-Leaved Deciduous, 2 Needle-Leaved Deciduous, 3 Broad-Leaved Evergreen, 4 Needle-Leaved Evergreen, 5 Dead, 6 *Deciduous*, 7 *Evergreen*

OW — *OPEN WATER/ Unknown Bottom*

In order to more adequately describe wetla... soil, or special modifiers may be applied at the class or lo...

WATER REGIME

Non-Tidal

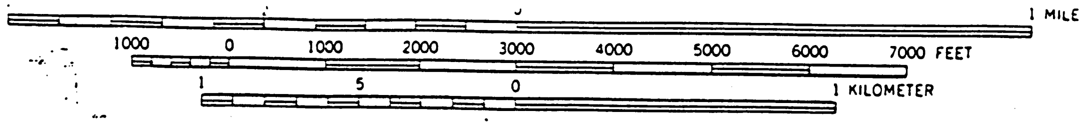
- A Temporarily Flooded
- B Saturated
- C Seasonally Flooded
- D *Seasonally Flooded/ Well Drained*
- E *Seasonally Flooded/ Saturated*
- F Semipermanently Flooded
- G Intermittently Exposed
- H Permanently Flooded
- J Intermittently Flooded
- K Artificially Flooded
- W Intermittently Flooded/Temporary
- Y Saturated/Semipermanent/ Seasonal
- Z Intermittently Exposed/Permanent
- U *Unknown*

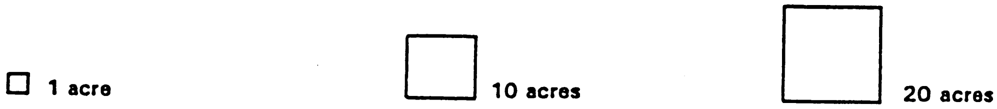
Tidal

- K *Artificially Flooded*
- L Subtidal
- M Irregularly Exposed
- N Regularly Flooded
- P Irregularly Flooded
- *S Temporary-Tidal
- *R Seasonal-Tidal
- *T Semipermanent-Tidal
- *V Permanent-Tidal
- U *Unknown*

*These water regimes are only used in tidally influenced, freshwater systems.

Figure 4:





ACREAGE GUIDE

Other information including a narrative report concerning the wetland resources depicted on this document may be available. For information, contact:

Regional Director (ARDE) Region III
U.S. Fish and Wildlife Service
Federal Bldg., Ft. Snelling (AD/BSP)
Twin Cities, Minnesota 55111

SYSTEM — **M — MARINE**

SUBSYSTEM — **1 — SUBTIDAL**

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	RF — REEF	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vascular 5 *Unknown Submergent*	1 Coral 3 Worm	

SUBSYSTEM — **2 — INTERTIDAL**

CLASS	AB — AQUATIC BED	RF — REEF	RS — ROC
Subclass	1 Algal 3 Rooted Vascular 5 *Unknown Submergent*	1 Coral 3 Worm	1 Bedrock 2 Rubble

SYSTEM — **R — RIVERINE**

SUBSYSTEM — **1 — TIDAL** · **2 — LOWER PERENNIAL** · **3 — UPPER PERENNIAL** · **4 — INTERMI**

CLASS	RB — ROCK	UB — UNCONSOLIDATED BOTTOM	*SB — STREAMBED	AB — AQUATIC BED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated

*STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.

**EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS. The remaining CLASSES are found in all SUBSYSTEMS.

SYSTEM — **P — PALUSTRINE**

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	US — UNCONSOLIDATED SHORE	ML — MOSS-LICHEN	EM — EMERGENT	SS —
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Bro Dec 2 Nee Dec 3 Bro Ever 4 Nee Ever 5 Dea 6 *Dec* 7 *Ever*

Figure 5:

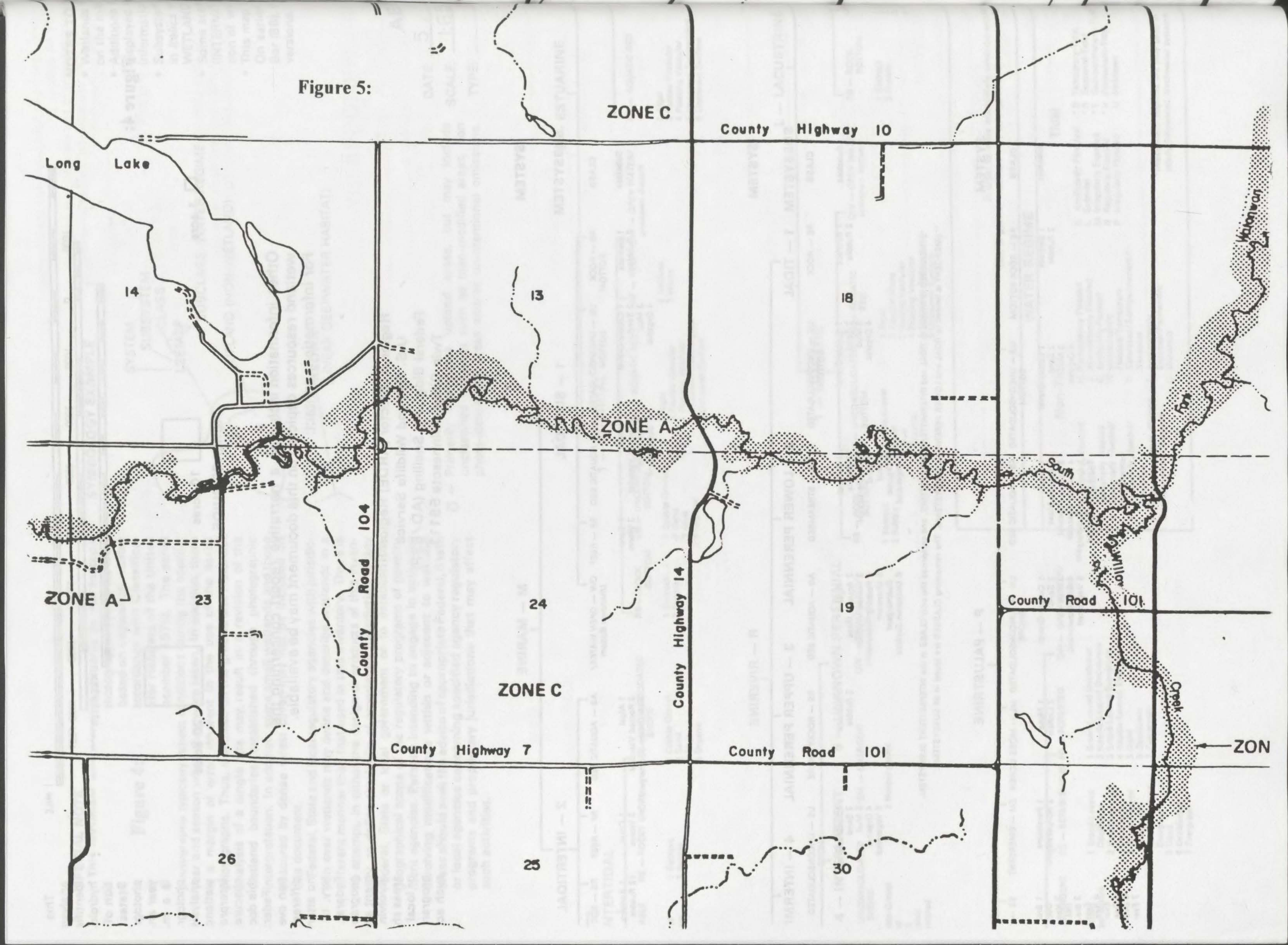
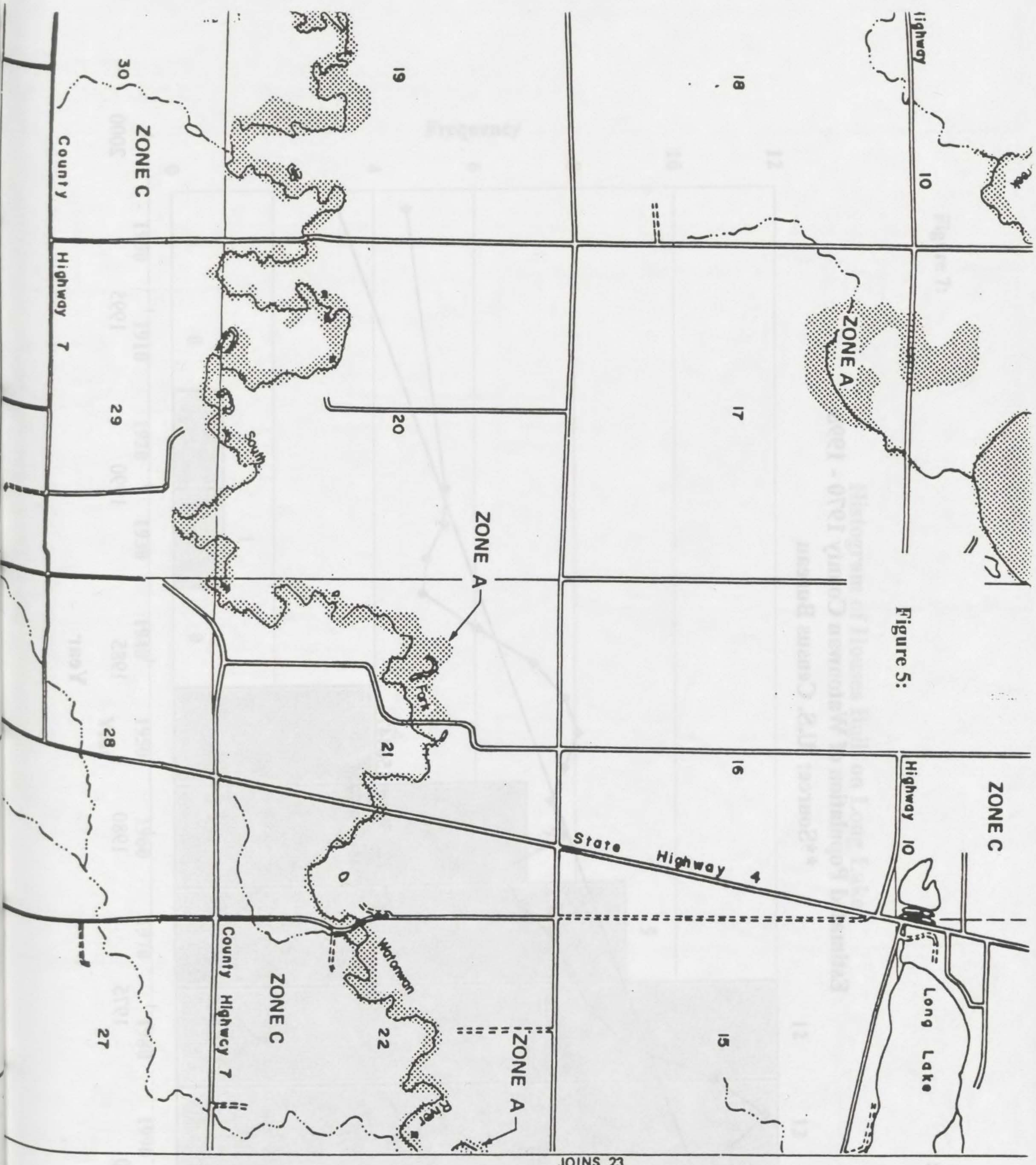
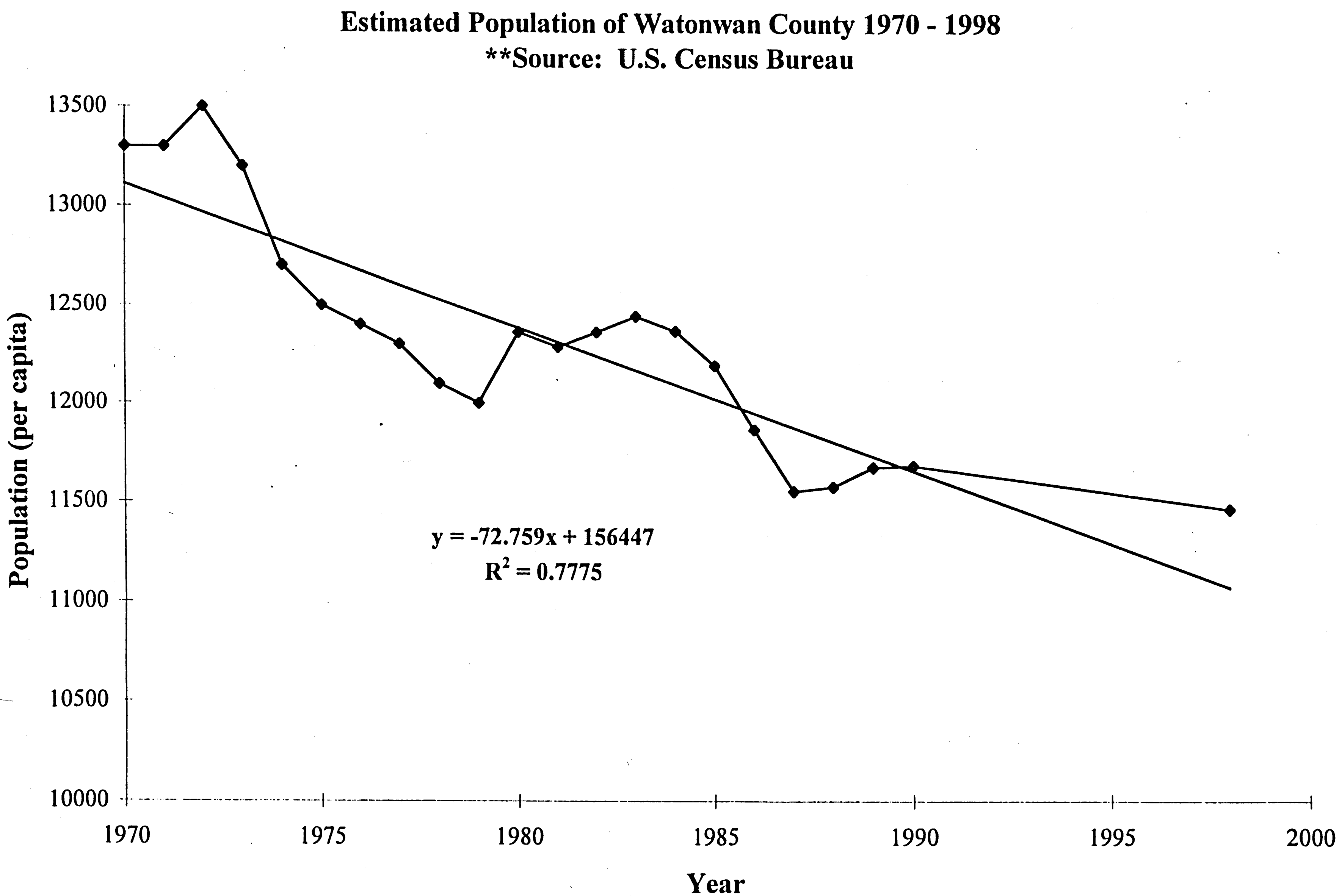

ZONE C
County Highway 10
Long Lake
14
13
18
ZONE A
South
Fork
Watonwan
Willow
Creek
County Road 104
County Highway 14
ZONE A
23
24
19
County Road 101
ZONE C
County Highway 7
County Road 101
ZON
26
25
30

Figure 5:



FEDERAL EMERGENCY MANAGEMENT AGENCY	APPROXIMATE SCALE
WATONWAN COUNTY, MN (UNINCORPORATED AREAS)	2000 0 2000 4000
	FLOOD INSURANCE RATE MAP COMMUNITY NUMBER 270649

Figure 6:



Estimated Population of Watonwan County 1970 - 1998
**Source: U.S. Census Bureau
13500
13000
12500
12000
11500
11000
10500
10000
Population (per capita)
y = -72.759x + 156447
$R^2 = 0.7775$
1970
1975
1980
1985
1990
1995
2000
Year

Figure 7:

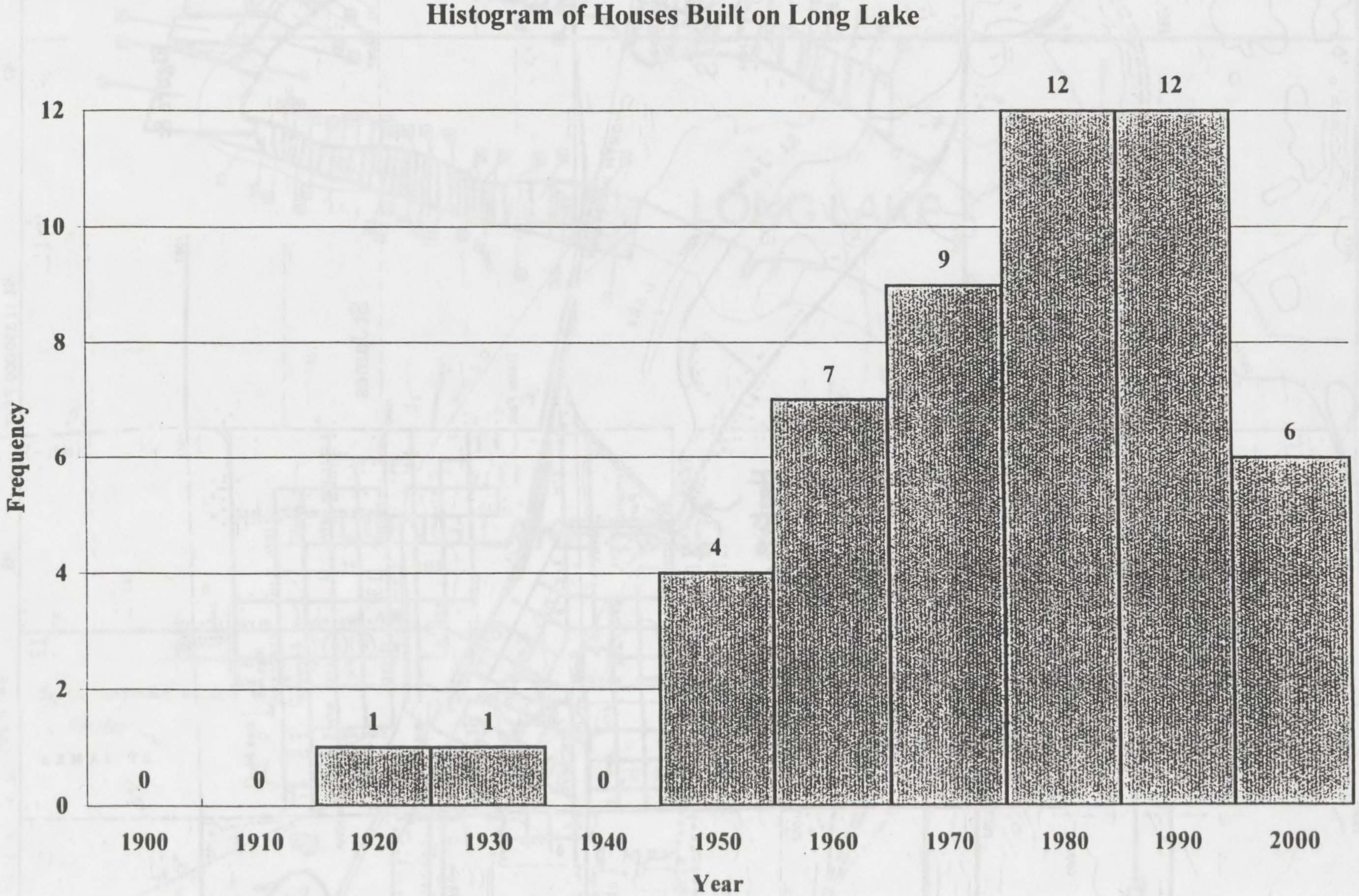
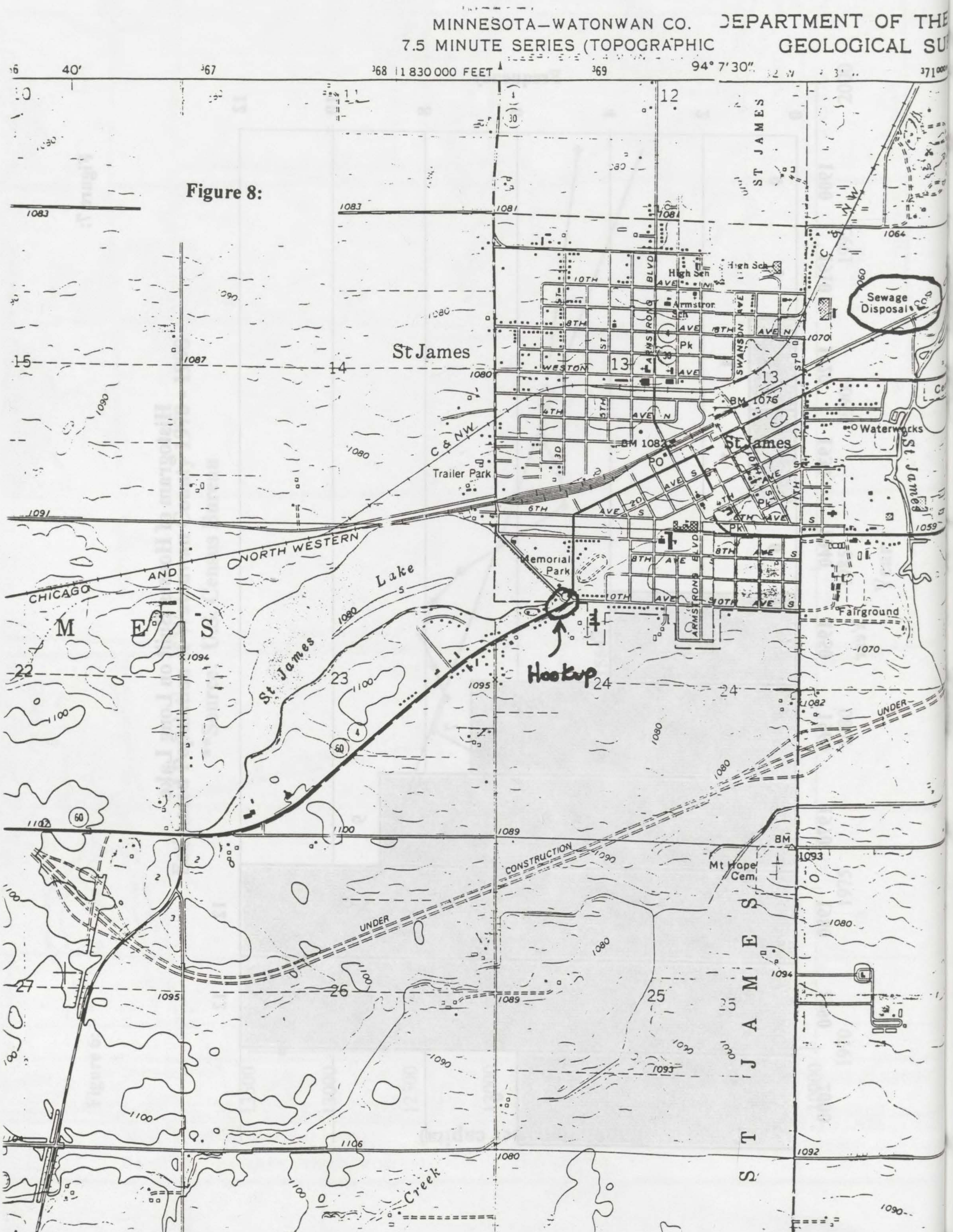
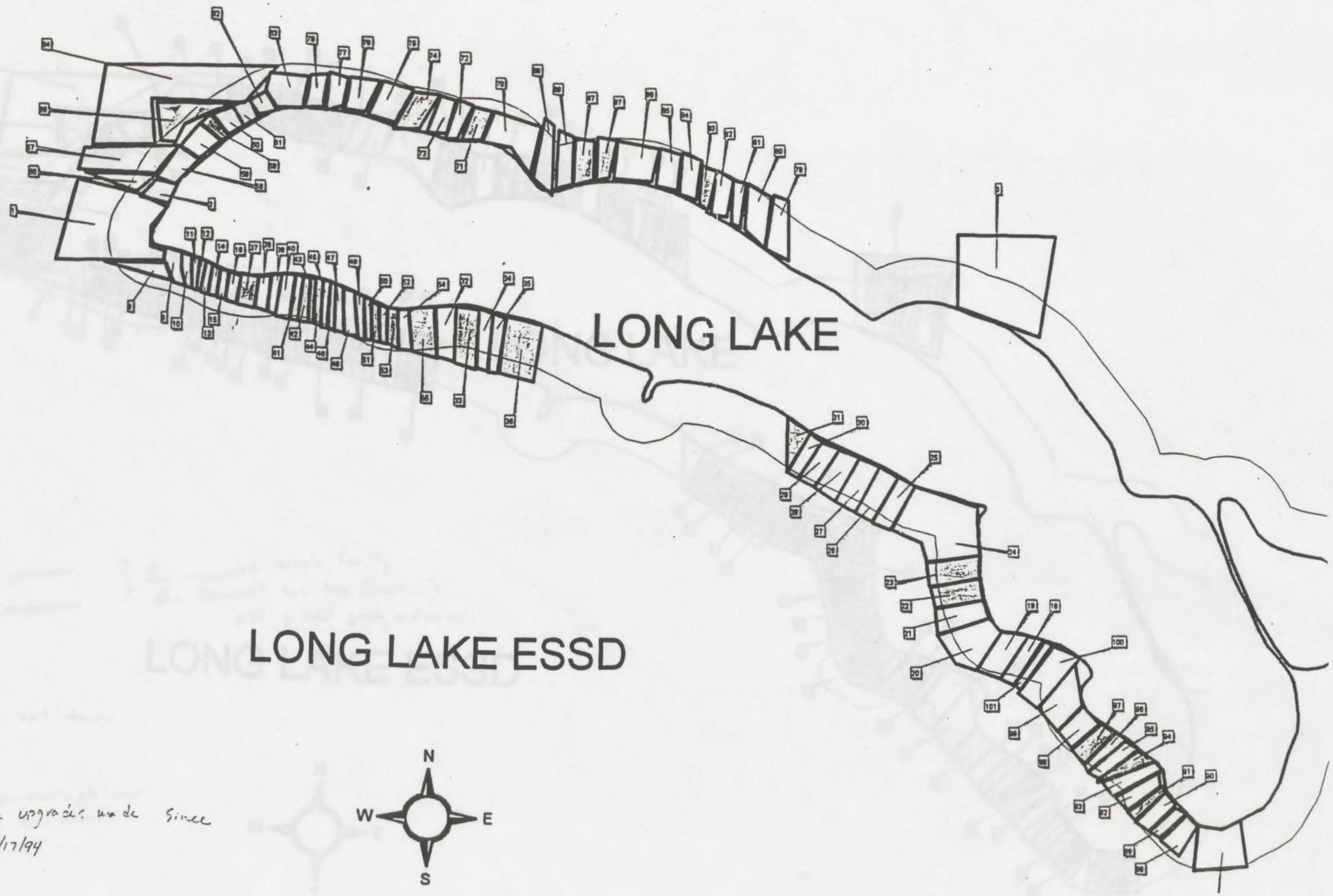

Histogram of Houses Built on Long Lake
Frequency
12
10
8
6
4
2
0
0
0
1
1
0
4
7
9
12
12
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

Figure 8:


MINNESOTA—WATONWAN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC
DEPARTMENT OF THE
GEOLOGICAL SU
94° 7'30"
St James
ST JAMES
High Sch
Armstrong Sch
Sewage Disposal
Waterworks
C & NW
Trailer Park
CHICAGO AND NORTH WESTERN
Lake
St James
Memorial Park
Hookup
Fairground
Mt Hope Cem
CONSTRUCTION
UNDER
Creek
M E S
J A M E S
S T

Septic upgrades made after 5/17/94

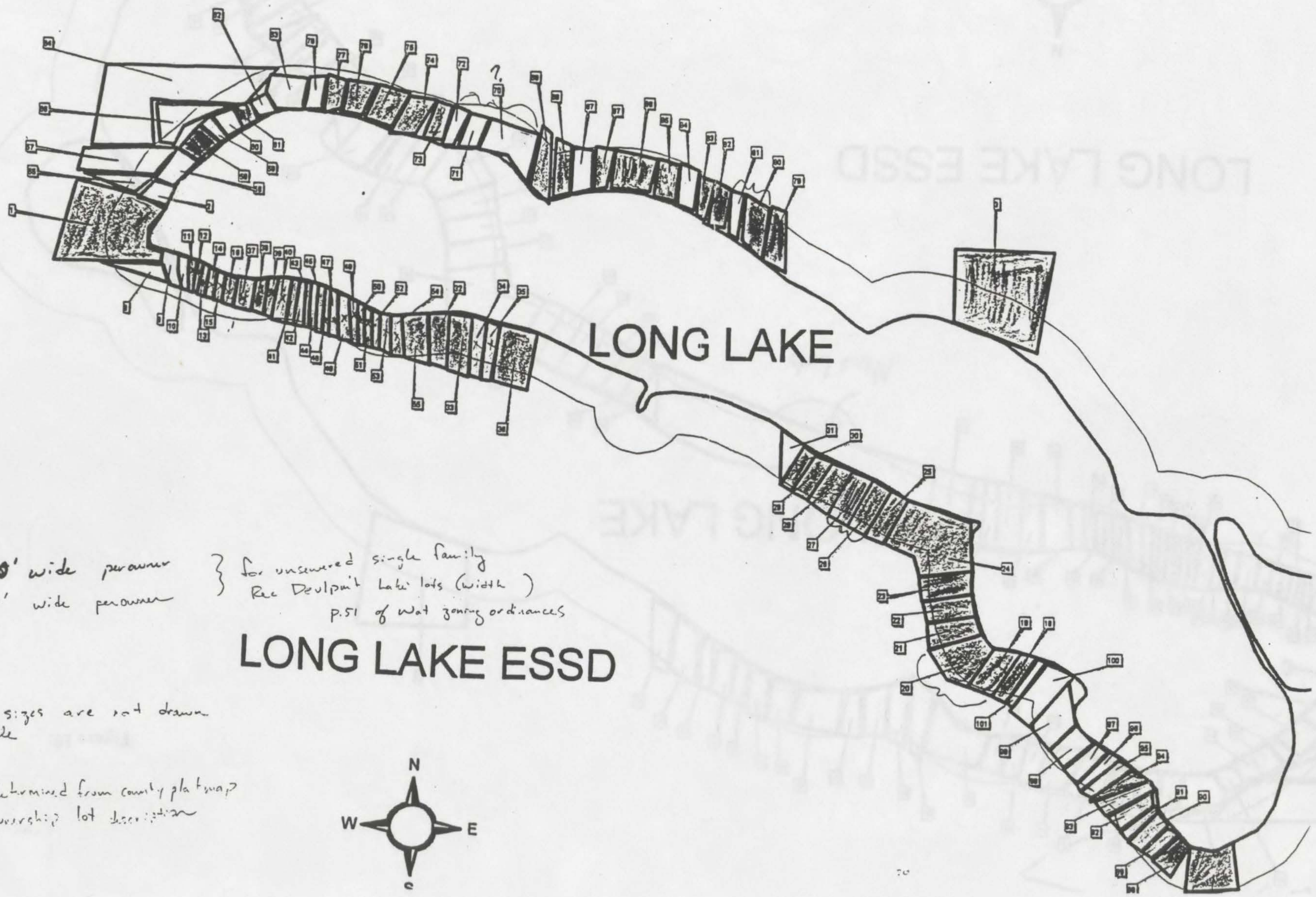
Figure 9:



Septic upgrades made since 5/17/94

ompliance / Non-compliance by lot size

Figure 9:



≥ 150' wide per owner

< 150' wide per owner

?

} for unsewered single family Rec Devlpmt Lake lots (width) p.51 of Wat zoning ordinances

* Lot sizes are not drawn to scale

Width determined from county plat map and ownership lot description

Figure 10:

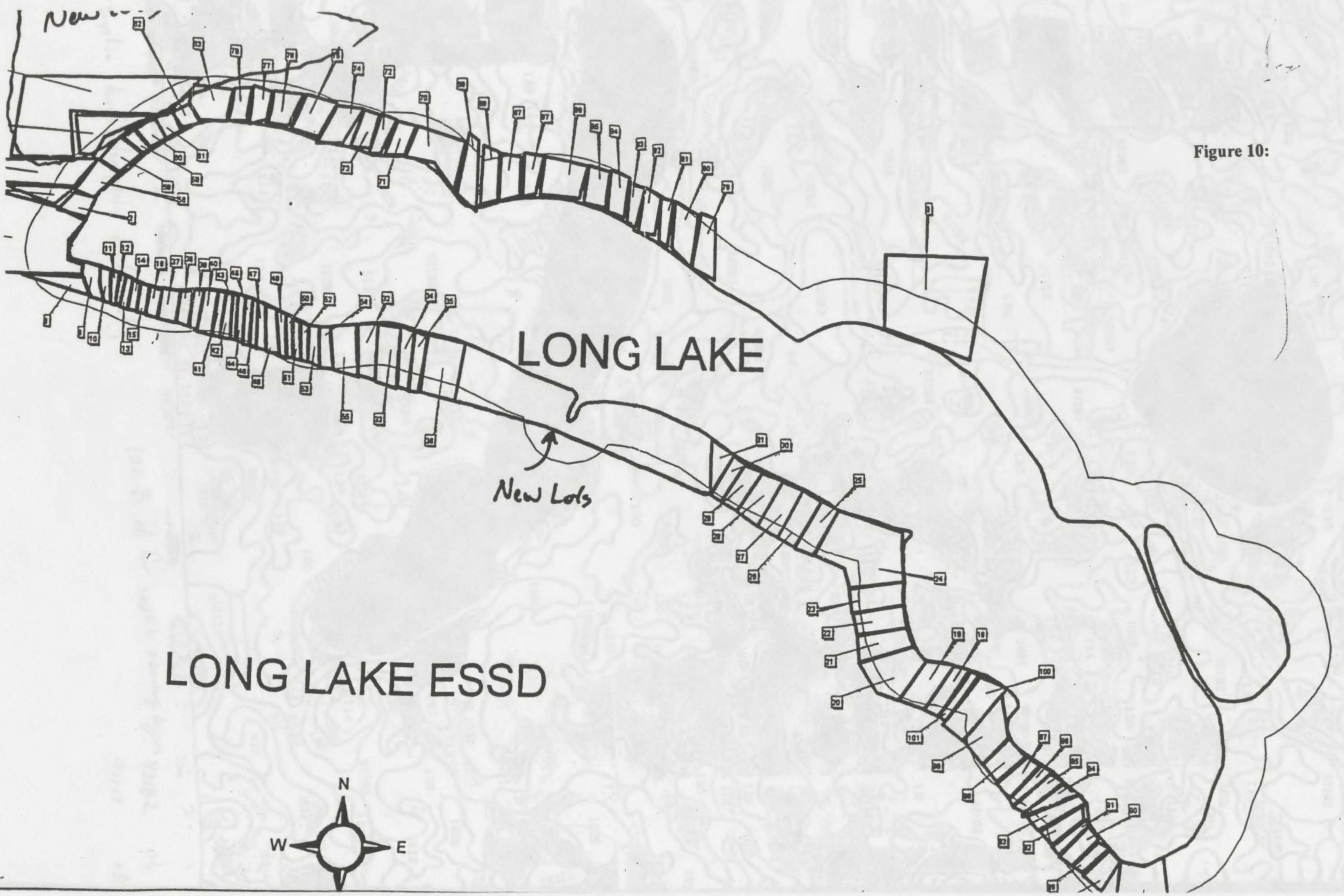
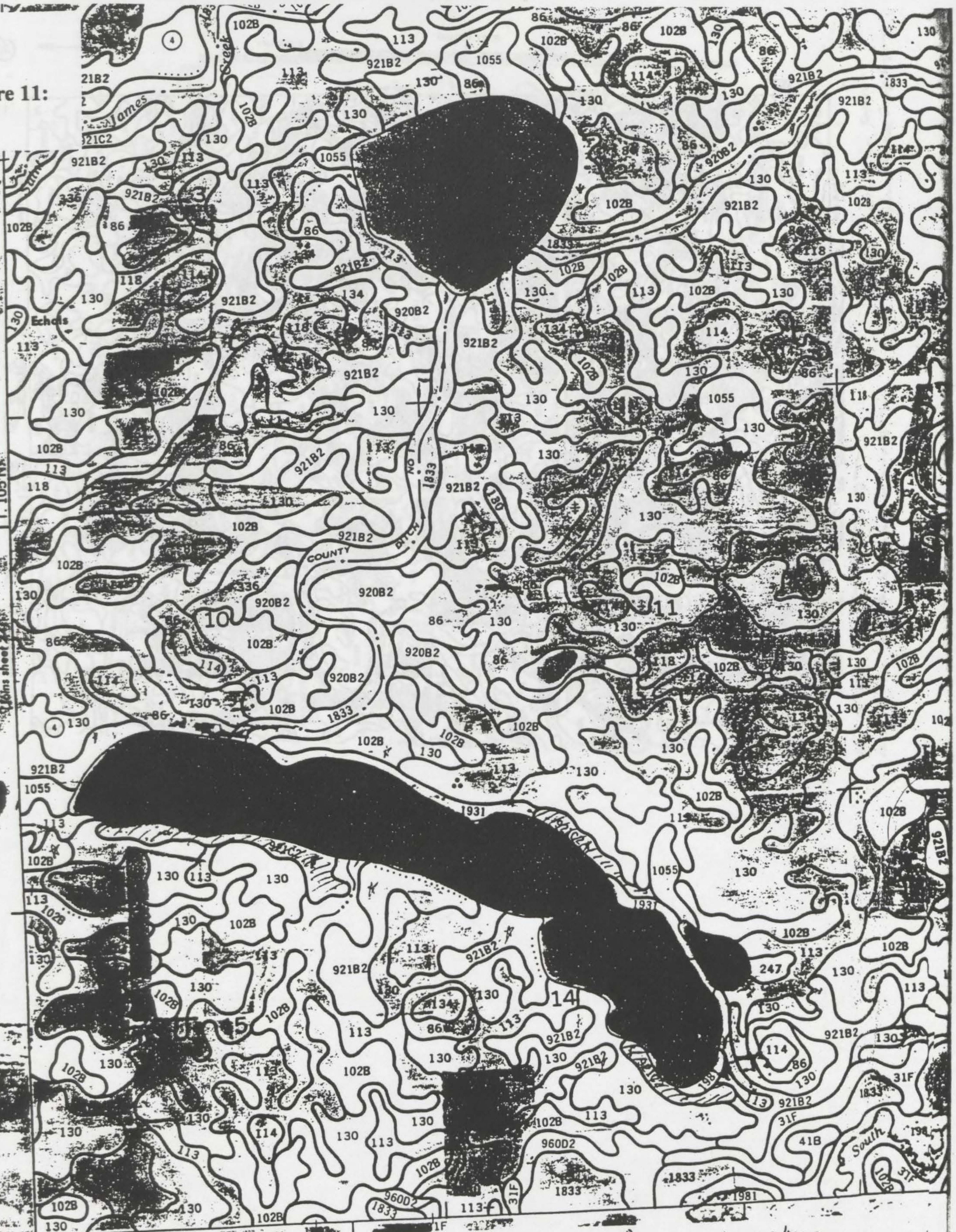


Figure 11:

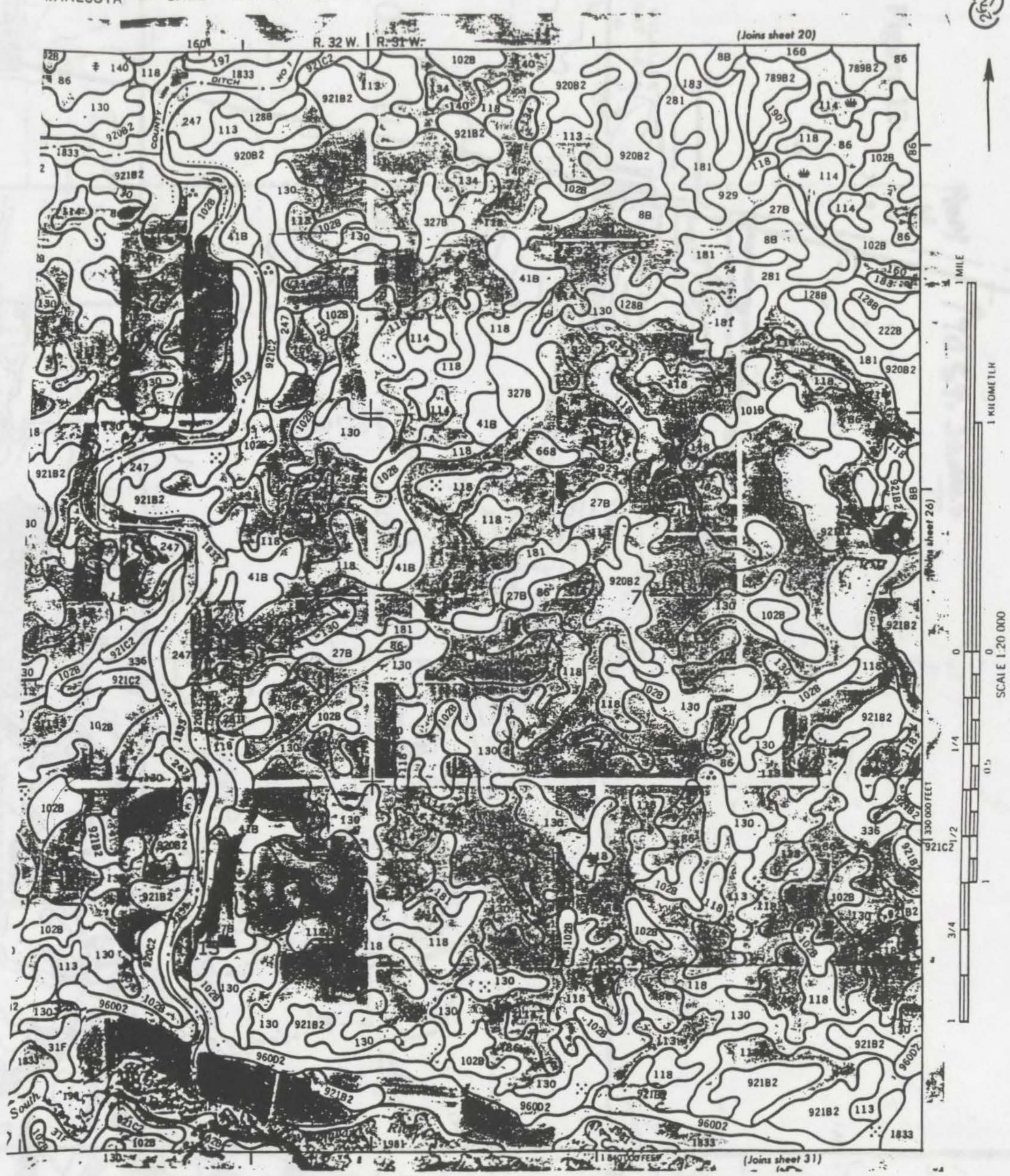


////// Septic tank adsorption field only

102 B ok for septic + sewag lagoon 921B2 ok

921C2 ok

MINNESOTA — SHEET NUMBER 25



1B2 ok for Septic tank + Sewage lagoon

'C2 ok for Septic tank / poor area for sewage lagoon

Possible locations for Septic tanks adsorption fields and Sewage lagoons

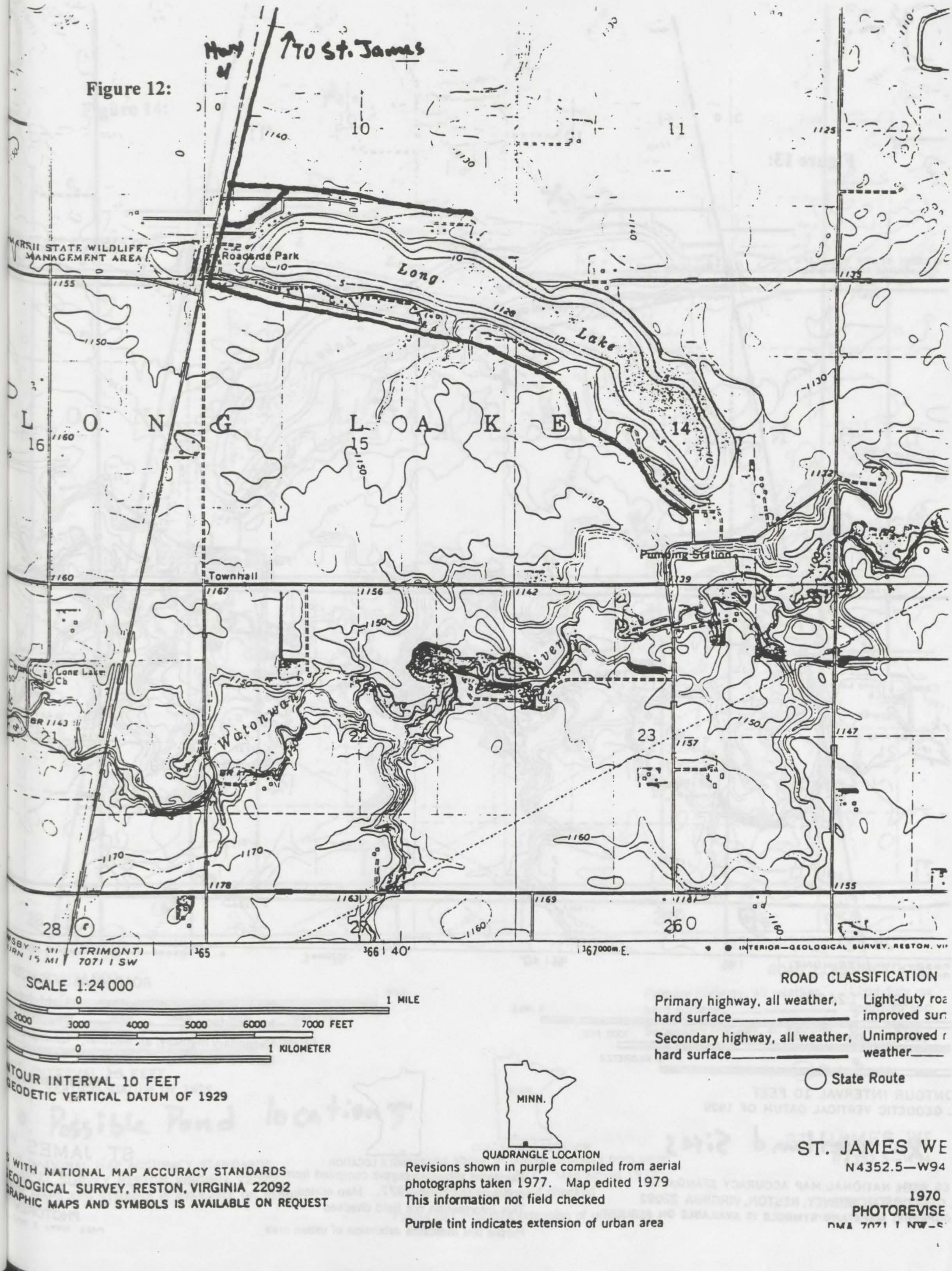
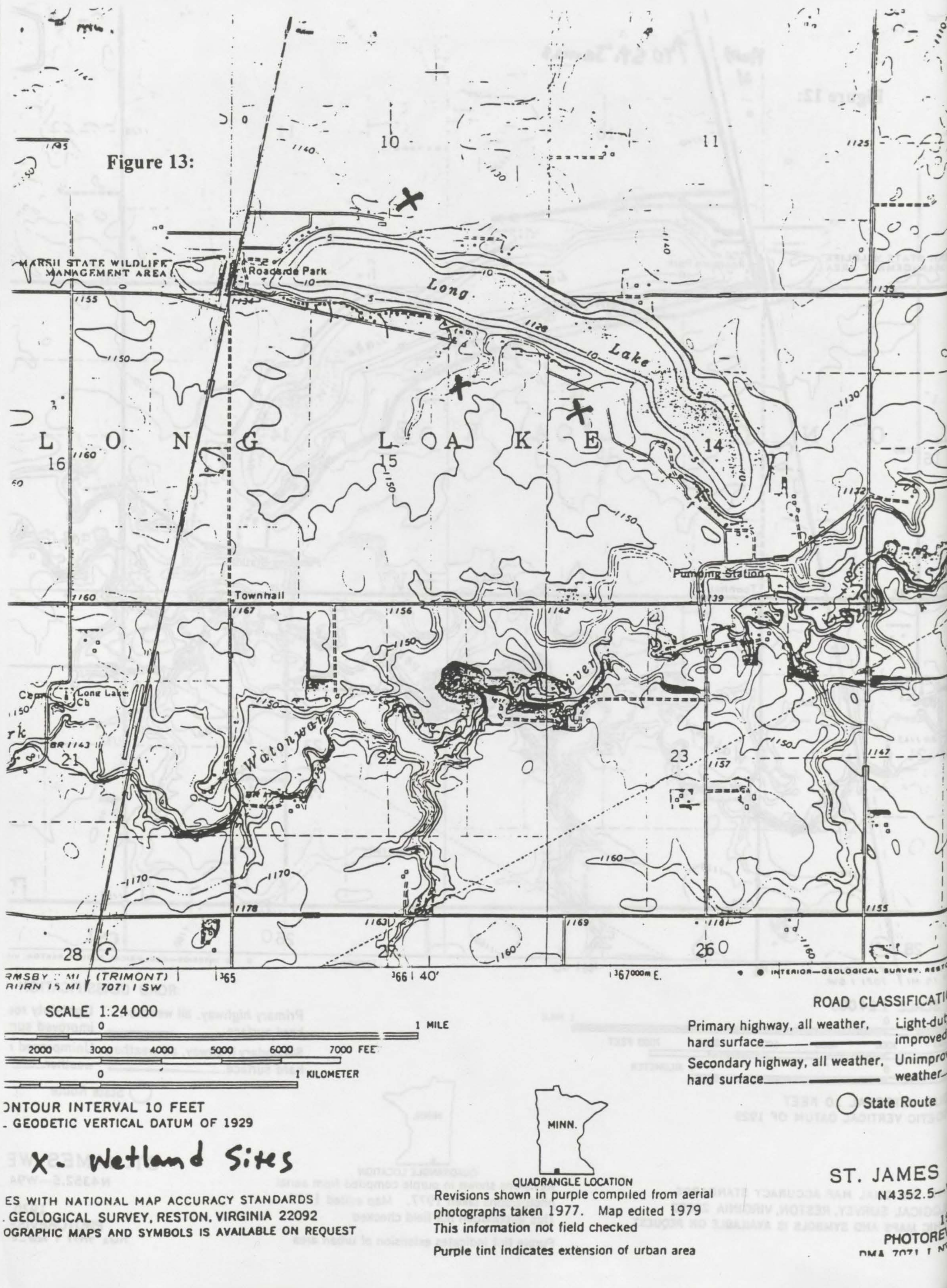
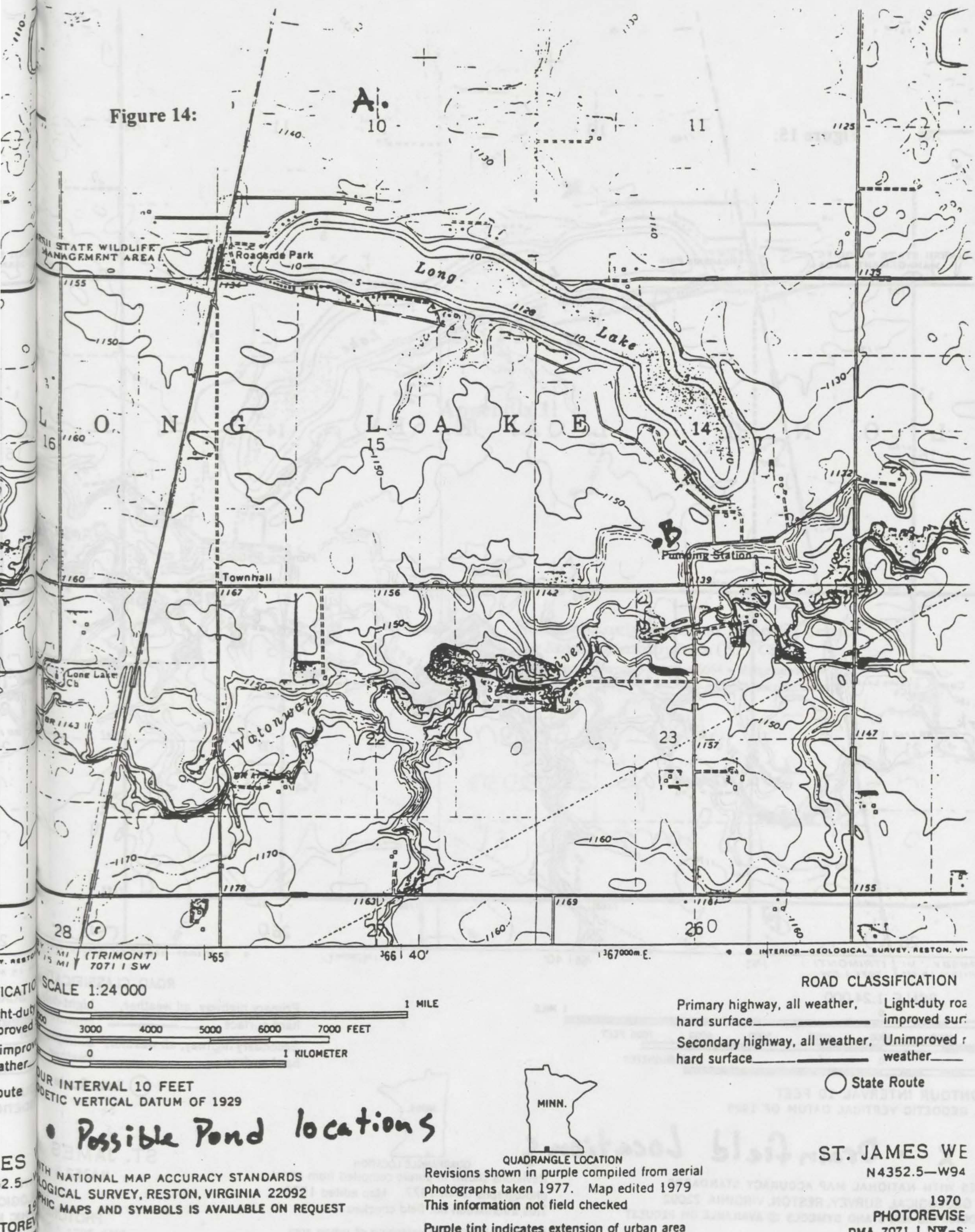

Hwy 4
To St. James
Figure 12:
10
11
MARSH STATE WILDLIFE
MANAGEMENT AREA
Roadside Park
Long Lake
L O N G L A K E
16
15
14
Townhall
Pumping Station
Long Lake Ch
Watonwan River
21
22
23
28
26
(TRIMONT)
7071 I SW
INTERIOR—GEOLOGICAL SURVEY, RESTON, VI
SCALE 1:24 000
1 MILE
7000 FEET
1 KILOMETER
NTOUR INTERVAL 10 FEET
GEODETIC VERTICAL DATUM OF 1929
ROAD CLASSIFICATION
Primary highway, all weather, hard surface
Secondary highway, all weather, hard surface
Light-duty roa improved sur
Unimproved r weather
State Route
MINN.
QUADRANGLE LOCATION
S WITH NATIONAL MAP ACCURACY STANDARDS
GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
GRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
Revisions shown in purple compiled from aerial photographs taken 1977. Map edited 1979
This information not field checked
Purple tint indicates extension of urban area
ST. JAMES WE
N4352.5—W94
1970
PHOTOREVISE

Figure 13:



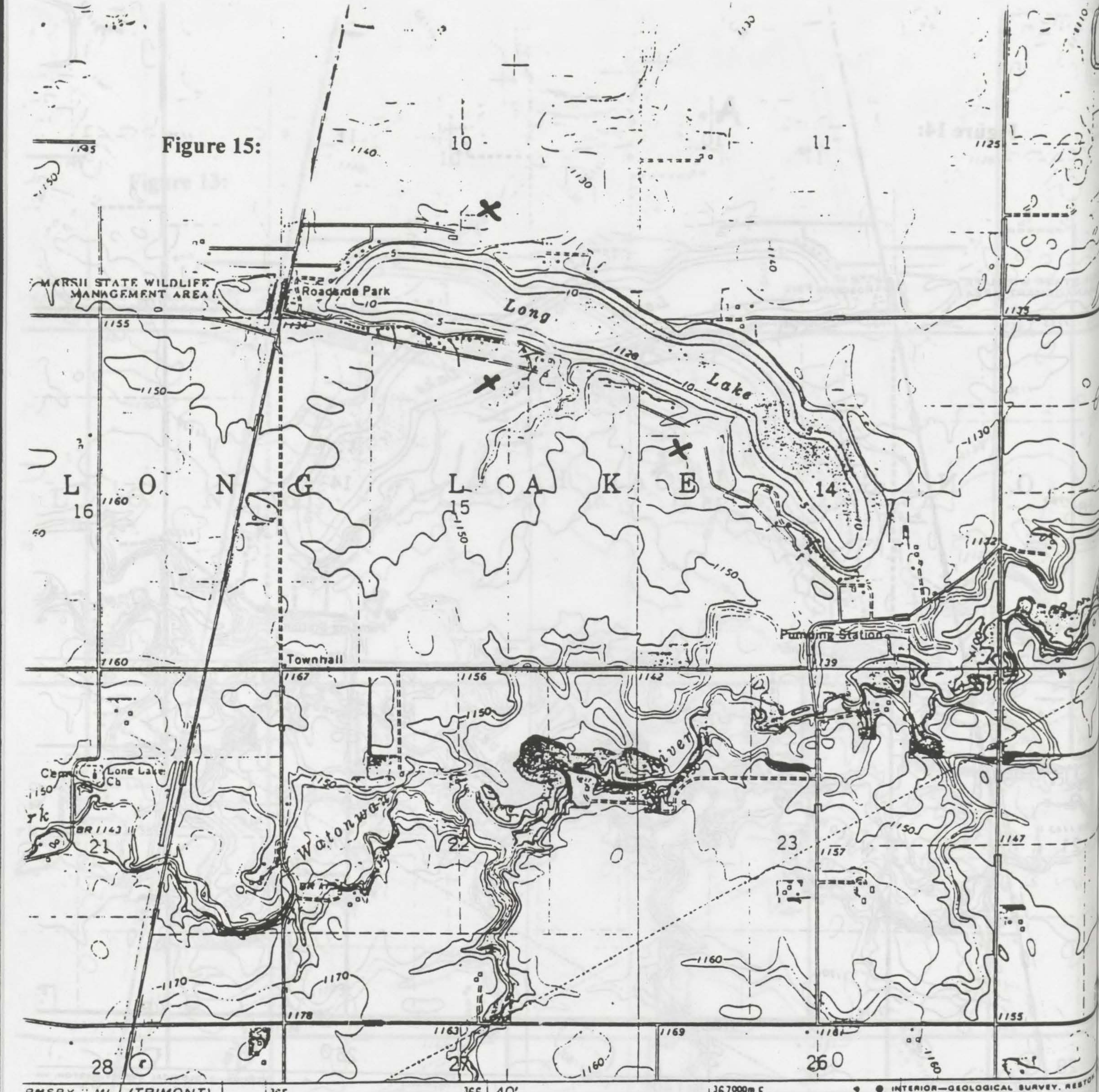
MARSH STATE WILDLIFE MANAGEMENT AREA
Roadside Park
Long Lake
L O N G L A K E
Pumping Station
Townhall
Long Lake Ch
Cem
Watonwan River
10
11
14
15
16
21
22
23
26
28
1160
1150
1130
1170
1125
1135
1155
1134
1128
1139
1142
1156
1167
1147
1157
1163
1169
1178
1155
(TRIMONT)
7071 I SW
365
366
40'
367000m E.
INTERIOR—GEOLOGICAL SURVEY, RESTON
SCALE 1:24 000
0
1 MILE
2000
3000
4000
5000
6000
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 10 FEET
GEODETIC VERTICAL DATUM OF 1929
X- Wetland Sites
ROAD CLASSIFICATION
Primary highway, all weather, hard surface
Secondary highway, all weather, hard surface
Light-duty improved
Unimproved weather
State Route
MINN.
QUADRANGLE LOCATION
Revisions shown in purple compiled from aerial photographs taken 1977. Map edited 1979
This information not field checked
Purple tint indicates extension of urban area
ST. JAMES
N4352.5
PHOTOREV
DMA 7071 I NE
ES WITH NATIONAL MAP ACCURACY STANDARDS
. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
OGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Figure 14:



• Possible Pond locations

Figure 15:



SCALE 1:24 000

0 — 1 MILE

2000 3000 4000 5000 6000 7000 FEET

0 — 1 KILOMETER

ONTOUR INTERVAL 10 FEET
L GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATIO

Primary highway, all weather, hard surface

Light-duty improved s

Secondary highway, all weather, hard surface

Unimprove weather

State Route

MINN.

QUADRANGLE LOCATION

X · Drainfield Locations

IES WITH NATIONAL MAP ACCURACY STANDARDS
. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
OGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

Revisions shown in purple compiled from aerial photographs taken 1977. Map edited 1979
This information not field checked
Purple tint indicates extension of urban area

ST. JAMES
N4352.5—W
19
PHOTOREV
DMA 7071 I NW

Appendix 1:

National Environmental Training Center for Small Communities (NETCSC)

West Virginia University • P.O. Box 6064 • Morgantown, WV 26506
(800) 624-8301 • (304) 293-4191 • http://www.netc.wvu.edu

Included well records for about 1/3 of homes.